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Polytechnic Association of the American Institute.

Meeting held March 20, 1872, President TILLMAN in the chair.

The PRESIDENT read the following items of scientific news :

I.—THE FLOW OF GLACIERS.—Prof. TYNDALL, in a recent lecture on the movement of glaciers, after describing the observations and measurements made by himself on the Mer de Glace, gives the following clear statement touching the relative motion of different parts of a crooked river of ice : When a glacier moves through a sinuous valley, the locus of the point of maximum motion does not coincide with the center of the glacier, but, on the contrary, always lies on the convex side of the central line. The locus is therefore a curved line more deeply sinuous than the valley itself, and therefore crosses the axis of the glacier at each point of the contrary flexure. This law holds good for water, substituting the word river for glacier. The idea, then, as to the similarity between a river and a glacier, becomes marvelously strengthened. The glacier is like a river, because the central part moves faster than the sides ; it is like a river, because its top moves faster than its bottom ; and again it is like a river, because the point of swiftest motion follows the sinuosities of its sides.

DR. RICHARDS said that these facts proved that the ice was not a solid body, but that there must be a softening and change of position of the different parts. It was now supposed that there was no such thing as an absolute solid.

II.—BALL LIGHTNING.—Mr. C. F. VARLEY has recently given to the Royal Society of London an account of new experiments made with a Holtz electric machine, having brass balls at the poles about an inch in diameter. A strip of wood about three inches in length, was bent around the negative pole, so as to project on each side of it towards the positive pole. On rotating the machine, two bright spots are seen on the positive pole. If the positive pole be made to rotate on its axis at the same time, the luminous spots do not rotate with it ; but when the negative pole, with its filament of wood, is rotated, the spots on the positive pole rotate also. On interposing a non-conductor, like plate-glass, between the poles, the luminous spots disappear. On removing the wood from the negative pole, there was sometimes a glow over a large portion of the surface of the positive ball. If, in this state, two or three small pieces of sealing-wax, or even a drop of water, be placed on the negative pole, corresponding nonluminous spots will appear on the positive pole, and these spots will rotate when the negative pole is rotated. It is evident that lines of force pass through the intervening air from the negative pole to the positive, a distance of about eight inches. This experiment, Mr. VARLEY believes, may explain the cause of "ball lightning." If a cloud be negatively electrified sufficiently strong to produce a flash from the earth, a point on such cloud would correspond to the projection of wood on the negative pole of the electric machine ; and such point moving along the surface of the cloud would cause a responsive action near the surface of the earth, and a luminous spot would appear, which has been described as "ball lightning" by those who have witnessed this rare phenomenon.

Dr. Bradley.—I think I have seen ball lightning. I saw it go into a mill, and it was all in flames in an instant. It seems to be totally unaccountable.

Dr. Van Der Weyde.—I have once seen a ball of lightning. This is the first explanation I have heard having any appearance of truth:

III.—MINERAL COTTON.—Mr. Coleman Sellers, of Philadelphia, exhibited, at a recent meeting of the Franklin Institute a sample of a product formed by allowing a jet of steam to escape through a stream of liquid slag, by which the slag is blown into the finest threads, sometimes two or three feet in length. These threads of glass readily break up into much shorter ones, which, being white, resemble cotton—hence the name. The material is a slow conductor of heat, and as great quantities of air must be retained in its interstices, it is well adapted to many purposes where so-called non-conductors of heat are required.

IV.—SINGULAR ACTION OF LIGHT UPON CHLORINE.—Mr. E. Budde has described, in *Pogg. Annalen*, No. 10, 1871, a series of experiments which show that chlorine gas expands much more under the action of the violet rays than when exposed to the red rays of the spectrum. The same result was obtained on substituting bromine for chlorine ; thus revealing the new fact that some bodies increase in volume under the actinic rays as others do under the heating rays. He offers the following explanation of the phenomenon: (1.) Light may decompose the chlorine molecule into atoms. (2.) The more refrangible rays of light may effect some unknown change which results in heat and causes expansion. (3.) It may be assumed that there are bodies which increase in temperature more under exposure to the violet than to the red rays. The author, regarding the first view as the most probable, believes the expansion of chlorine is the effect of a temporary separation of atoms under the influence of the more refrangible rays.

DR. VAN DER WEYDE.—The first explanation I think is the most probable. It may be that light has the same effect upon substances as ozone. If that is the case the volume must increase. Ozone is heavier than oxygen ; for three atoms of ozone have the same volume as two atoms of oxygen. If we could split up all the chlorine into single atoms it would double its volume.

THE PRESIDENT.—The greatest expanding power of the spectrum is the red ray ; and as these substances expand most in the violet ray, the only explanation is that the effect is produced by actual chemical decomposition.

Dr. VAN DER WEYDE : Hydrogen and chlorine, when exposed to the actinic ray, will suddenly combine. When chlorine alone is exposed to the actinic ray it will partially combine with hydrogen ; and on this fact Bunsen has formed an actino-meter. If the actinic ray decomposes chlorine into single atoms, it predisposes it to combination with hydrogen, for which the single atom is required. There seems to be intimate relation between this discovery and that known fact.

SKELETON LEAVES.—Mr. J. F. ROBINSON describes in *Hardwick's Science Gossip* a simple method of preparing skeleton leaves, which seems preferable to the old and tedious method of maceration, and which he recommends to all young botanists, especially to his fair friends, who take up the science of botany more as an intelligent amusement than for severe study. First dissolve four ounces of common washing soda in a quart of boiling water, then add two ounces of slaked quicklime, and boil for about fifteen minutes. Allow the solution to cool ; afterwards pour off all the clear liquor into a clean saucepan. When this liquor is at its boiling heat place the leaves carefully in the pan, and boil the whole together for an hour, adding from time to time enough water to make up for the loss by evaporation. The epidermis and parenchyma of some leaves will more readily separate than others. A good test is to try the leaves after they have been gently boiling for an hour, and if the cellular matter does not easily rub off betwixt the finger and thumb beneath cold water, boil them again for a short time. When the fleshy matter is found to be sufficiently softened, rub them separately but very gently beneath cold water until the perfect skeleton is exposed. The skeletons, at first, are of a dirty-white color ; to make them of a pure white, and therefore more beautiful, all that is necessary is to bleach them in a weak solution of chloride of lime—a large teaspoonful of chloride of lime to a quart of water ; if a few drops of vinegar is added to the solution, it is all the better, for then the free chlorine is liberated. Do not allow them to remain too long in the bleaching liquor, or they become too brittle, and cannot afterwards be handled without injury. About 15 minutes will be sufficient to make them white and clean-looking. Dry the specimens in white blotting-paper, beneath a gentle pressure. Simple leaves are the best for young beginners to experiment upon ; the vine, poplar, beech, and ivy leaves make excellent skeletons. Care must be exercised in the selection of leaves, as well as the period of the year and the state of the atmosphere when the specimens are collected ; otherwise, failure will be the result. The best months to gather the specimens are July and August. Never collect specimens in damp weather, and none but perfectly matured leaves ought to be selected.

FLUORESCENCE.

HENRY MORTON, President of the Stevens Institute, delivered a lecture on Fluorescence, illustrated by many brilliant experiments.—Adjourned.

Meeting held April 19, 1872, President TILLMAN in the chair.

The PRESIDENT read the following paper :

NEW RECORDING INSTRUMENT FOR SUBMARINE TELEGRAPHS.—Until quite recently, the only telegraphic instrument which could be used in connection with the very feeble electric force manifested through long submarine cables, is that known as the mirror-galvanometer, by which a spot of light is made to follow, in its movements, every variation in that force ; and these varying strengths being followed by the eye, are thus interpreted under circumstances in which ordinary telegraphic instruments indicating the mere presence or absence of a given current would be useless. The author of this mirror-galvanometer, Sir William Thompson, has invented another instrument that records the transmitted message. It is now in practical operation at the terminus of the French cable at Duxbury, Mass. His instrument draws or marks on a strip of paper a curved or broken line, giving graphic representation of the varying strength of the current ; or, if required, of electric potential at the receiving end of the cable, and gives a permanent record of every feature of the effect due to the sender's action. The instrument is available for the system of varying strength, including, of course, the simplest system, viz. ; of two strengths called positive and negative,

or for the system of long and short signals, of which the Morse alphabet is the simplest type.

The difficulty in producing such a recorder as this has been due to the difficulty of obtaining marks from a very light body in rapid motion without impeding that motion. To effect this, the inventor connects (either by direct attachment, or by a stretched thread or fibre) to the body moved by the received current, a light marking-needle or tube, from the end of which ink or other fluid is spurted upon paper. The signals which are to be recorded give rise to motions of the marking end, which are parallel to the plane of the paper, while the paper is drawn along its own plane, and in a direction perpendicular to the line of the motions caused by signals. He employs for the marking-needle, by preference, a capillary tube, or a bristle, dipping at one end into a stationary reservoir of ink or other fluid, and he causes such fluid to be spurted from or drawn from the opposite end, by means of an electric force, or by means of rapid vibrations maintained in the needle or in the paper, in a direction perpendicular to the plane of the paper. These vibrations may be maintained mechanically or pneumatically, as by the agency of sound, so that the paper receives ink by a succession of fine contacts, between each of which the tube or bristle is quite free to move. When the electric method is used the paper is drawn over a metal plate, electrified, say, positively, and the capillary tube negatively, and a powerful difference of potential is maintained between the tube and the metal plate, such as would tend to cause a succession of sparks to pass between them, and which, in the circumstances, produce a fine stream of ink, or a succession of fine dots spurted from the tube on to the paper, leaving a record of the position of the tube at each instant, and drawing a sensibly continuous line on the paper without impeding by friction the motion of the tube, as directed by the receiving instrument. It has been found most convenient to let the paper move in a vertical plane, and to use a small glass siphon, with its short leg dipping in the ink reservoir, and its long leg pointing obliquely downward at the paper and close to it. The receiving instrument used in connection with this marking apparatus is a peculiar arrangement, in which the received current passes through a very light coil of a small number of turns of fine wire. Part of this coil is placed in a very powerful magnetic field, produced by permanent magnets, or by electro-magnets, which act with great force on the coil when the current passes through it. The coil is kept stiff, without any complete frame-work or bobbin, by the use of stiff pieces, or booms, drawn asunder by threads or strong fibers stretched to fixed points, and serving to support the coil while giving it the requisite freedom to move and the needful stability. The message recorded by this ingenious apparatus appears like a continuous line, but when examined closely it is found to be made up of a series of ink dots. The line made in a longitudinal direction corresponds to spaces in the Morse alphabet made by breaking the current, and the to and fro transverse lines, which may be long or short, as the cable current varies in strength, accomplish the same purpose as the dot and line made by the Morse pen. Thus the swinging motion of a delicate coil is perfectly recorded with a minimum expenditure of force. The inventor has accomplished what was deemed an impossibility by most electricians, and brought out an instrument which is not only theoretically correct in its construction, but which has been found to work well in actual practice.

Dr. L. BRADLEY spoke of the progress made in telegraphing in the United States; lines now being worked by the fluctuation of the tension of the electricity, no current going through the line.

LIGNITES OF THE FAR WEST.

Prof. NEWBERRY delivered a lecture on this subject, which we have already published.—Adjourned.

Uses of Blast Furnace Slags.*

BY T. EGLESTON, E. M.

If we may characterize the aim of metallurgists twenty years ago by any one point towards which their efforts were especially directed, we should say it was the idea of adapting "waste products" to some useful purpose, while the energy of to-day seems rather to take the direction of so arranging processes as to have no "waste products." The iron master of this decade no longer speaks of the *waste gases* of the blast furnace. The supply of combustible material from this source is a part of the regular working, and is depended upon to such an extent that in many cases it is doubtful, whether the iron could be profitably manufactured without its use. This is an economical age, and in large works the same care that looks after the saving and utilizing of material not hitherto available, presupposes, as a general thing, skill in the manufacture of the product. There is hardly a point in the whole range of metallurgical detail, where more or less successful attempts have not been made to economize, by the use of "waste products," and no one thing, upon which greater skill has been lavished, and so much money spent. The operations are so large, the capital involved so great, that a comparatively small saving will often justify even the abandonment of one process for another, as was the case in the introduction of Patinsonage in place of the costly process of enrichment by Cupellation, and the substitution, recently, in many places in Europe, of the Zinc process for Patinsonage.

In the metallurgy of iron the most cumbersome, expensive, and useless product is the blast furnace slag. The variety and ingenuity of plans proposed to make use of it, or in some way utilize the heat it absorbs, or at least to get rid of it, is only equalled by the persistent want of success which these efforts have, until within a few years, attained. The amount of slag which flows from an ordinary blast furnace in twenty-four hours may be calculated at very nearly twice the production in iron by weight and five to six times by bulk. The amount of heat absorbed by and radiated from this mass of material, if it could be transformed into horse power, would make very important changes in our present methods of manufacture, and materially diminish the cost of the iron. Besides the large amount of heat lost in the slag, it is a constant source of inconvenience, accumulating near the furnace, as a hot viscous mass, difficult to handle, requiring special tools for its removal, and necessitating the investment of a large amount of capital in land on which to pile it, which brings no return of any kind. The labor spent upon this unproductive substance is often equal to the whole of the productive labor of the furnace. Hence the amount of skill lavished first to make use of it and then to get rid of it.

The first attempt, and for a long time, the only one to use it was in making roads, for which it was simply broken up by hand, and then used like any other stone. Though in themselves excellent road making material, this form of slag is not well suited for it, and hence, as this is the only use generally known, we find enormous slag heaps, which are often over one hundred feet high, served by special engines and cars, in the vicinity of many of our blast furnaces. Happy the company, who, like the Hudson Iron Works, can use their slags to fill in shallow bays, and thus by an actual production of lands, turn all their slags to profitable account.

In some parts of Europe where stone is exceedingly scarce, this is the only material for road making that can be procured in large quantities. Hence, in such countries as Silesia, every effort has been made to make the only material they have as well adapted for the purpose as possible.

The great objection to the use of slags is their brittleness. Hence very early attempts were made to devitrify them at a small cost. This necessitates a cheap fuel, which is generally an exception, and hence the most successful attempts at devitrification have been the accumulation of the slag in large masses, allowing it to cool slowly under considerable pressure. This is the case at Tarnowitz in Silesia, and elsewhere where the ground around the furnaces is encumbered for days together with large accumulations of slag, a foot or eighteen inches in thickness, which are left to cool. This method is necessarily imperfect. Only the lower half of the slag is devitrified, but imperfect as it is, it furnishes an excellent material for paving, and the traveller would generally be astonished to learn that the pavement over which he rides is nothing more than an imperfectly devitrified blast furnace slag. As only a very small portion of the slag can be used in this way, slag heaps in Silesia would be quite as prominent a feature of the landscape, as they are in the Lehigh Valley, if the furnaces were as numerous. The benefit in this case is on the side of the road maker, rather than on that of the iron manufacturer.

The necessity of having building stone in certain countries of Europe, where it is very scarce, led to a long series of experiments, which, after a multitude of failures, resulted in the manufacture of a very useful product for certain kinds of construction. These experiments began at a charcoal blast furnace, the slag from which was taken out of the fore-hearth with a ladle, compressed into a mould and cooled slowly. In order to keep the slag in the hearth from becoming cool it was covered over with charcoal. A small quantity of the powder of the charcoal became mixed with the slag, and effected a partial devitrification in the moulds. The attempt to apply this exceedingly simple process to a coke furnace failed entirely. The bricks became too porous from the evolution of gases resulting from the admixture of coal dust. Sand and coke dust were then substituted, but as the bricks were still fragile they are now annealed in furnaces. This process is applied in Königshütte in Silesia to the manufacture of building material of which some of the important constructions of the works are built. The slag is run from the furnace into a hemi-spherical basin on wheels. The bottom of this basin is covered with sand or fine coke dust, to the depth of about 3 centimeters. The wagon is then drawn to the point where the bricks are to be made. The slag and sand are mixed together with a curved iron tool until most of the gases have escaped, and the mass is about the consistency of dough. It is then drawn with the same tool into a mould with a hinged cover, and punctured several times to let out the gas. The cover, which fits into the mould, is then turned down and the slag becomes compressed. By the time three or four moulds have been filled, the first slag brick is sufficiently solid to be removed. This is done by raising a clamp which allows the mould to separate. The red hot brick is now drawn into a kiln, covered over with powdered coal and left to anneal. Each kiln contains 1000 bricks and is from three to four days in cooling. Four men can make 500 of these bricks in three hours. The loss in the manufacture from breakage is about 20 per cent. The cost of annealing is about two thalers the 1000. These bricks are rough on their surfaces, but on account of their larger size do not require more mortar than an ordinary brick. They do not readily absorb moisture, and for that reason are extensively used in the construction of foundations. The pillars supporting the main wind pipes at Königshütte are built of this material. In Silesia these bricks cost 25 per cent. less than ordinary brick.

A brick much inferior to these in every respect is made in the Hartz Mountains out of the lead furnace slags, which are silicates of iron. These are moulded and compressed and are used for buildings. As the bricks are very brittle, the constructions in which they are used are generally covered with a coat of mortar. The buildings of the immense mechanical preparation works of Clausthal are built of this material.

* A paper read before the American Institute of Mining Engineers, at the Philadelphia Meeting, February 23.

Mr. SEPULCRE, a Belgian engineer, was one of the first who successfully transformed the slag into a stone which could be generally used. This he effected by causing the slag channels to terminate in an excavation whose sides had an inclination of about 30° and whose capacity varied from a half to ten cubic metres. The very steep inclination of the sides causes the section of the pits to increase very rapidly and this allows the solid crust, which forms on the surface of the liquid slag, to rise with it without becoming attached. The slag must flow continuously into the excavation, and if, for any cause, there is an interruption the crust must be raised to allow of the liquid material flowing underneath. In this manner the whole mass of slag in the pit is sure to be all liquid and will solidify from above and under pressure. After the excavation is full it is left for five to ten days to cool, the only precaution required being to cover the top with ashes or sand to a sufficient depth to prevent the mass from cooling too rapidly. The stone so produced, grows hard on exposure to the air. When first made it can be easily broken into any required shape, but after exposure for a period more or less long, it becomes so much harder as to require double the number of tools to work it.

All kinds of slag are not suitable for this manufacture; those which contain too much lime fall to pieces on exposure. In general, it may be said that they should contain from 38 to 44 per cent. of silica, and that the furnace should be working well.

According to experiments made at the Conservatoir des Arts et Métiers in Paris, this stone, when made from slag while the furnace was running on white iron never became fissured under a pressure of less than 242 k. the square centimetre, and was crushed at a pressure of 886 k. as a minimum. When made from grey iron they do not crush under a pressure of less than 405 k., but they have fissures at a pressure as low as 222 k. or a little less than the white iron slags. This material is, therefore, stronger than the best marble.

One of the Belgian furnaces, which produced 2,500 tons of slag in 30 days, made from it 1,177 cubic metres of stone. The expense of manufacture was $820. The material sold for $1600, making a profit of $780 in thirty days; 70 per cent. of the slag produced was profitably used. In order to introduce it the price was put 25 per cent. lower than ordinary stone.

In certain parts of Germany and during the late war in our own country, basalt and certain volcanic rocks were used in the manufacture of glass. But little is wanting in certain blast furnace slags to make them of the same composition as basalt, and this fact suggested their use in the manufacture of glass. The experiments which were made with slag were so successful that in some parts of Belgium, some of the glass makers have contracted with the blast furnaces to furnish them a certain amount of slag every week. One furnace producing 30 tons of cast iron in 24 hours, that I visited, during the last summer furnished one day's run of slag per week to the glass makers. To prepare it for this use the slag is run out on cast iron plates and cooled with water.

Attempts have been made in some parts of Europe to use the heat evolved by the slags for domestic purposes. The most simple and the most practical one is the employment of the heat of the slag by the men for cooking, or heating their food already cooked. Attempts have been made to use it for heating the house, near the furnace, by allowing it to run into iron moulds and placing them in a drum, but the expense attendant upon it and the trouble of constantly changing the slags probably cost more than the saving of fuel and undoubtedly kept the unfortunate persons who were subject to this expensive economy in an uncomfortable state both of mind and body.

Mr. MINARY, director of the Franche Comté Iron Company, conceived the idea of using the slags by granulating them as they flow from the furnace. To do this the trough through which the slags run is made to terminate in a stream of water which has sufficient velocity to carry the grains of slag into a pit prepared for it, from which it is charged into wagons, without further expense, by an endless chain with buckets. The engine for this purpose is run by the gases of the furnace, and requires scarcely a horse-power. In these works, which consist of five blast furnaces, each producing 20 tons in 24 hours, the introduction of this improvement resulted in a saving of the wages of 20 men occupied in charging the slags, and of 5 blacksmiths who repaired their tools. Much larger wagons were brought to the furnace, which, as the granulated slag can be discharged at any height by the endless chain, were for the most part railroad cars. No one is now employed to look after the slags, as the whole of the work can be done by the founder and his assistant. The saving thus effected amounts to 5 to 6000 francs a year, while the cost of granulation does not exceed $0.07 the ton of slag. This rendered the slag portable by the ordinary methods of transportation, did away with all the special tools formerly used and reduced the labor of getting rid of the slags to almost nothing.

The granulated slag was first used as gravel in the works and to make the bed of the casting house. It was found that from such a casting bed the pigs came out clean and bright, and were preferred by the puddlers even to those cast in iron moulds. This method of using the slag is now of almost universal application in the Siegen district in Prussia, where most of the furnaces run on Spiegel. The grains of iron which the slag contains were formerly separated by stamping. They are now separated by the granulation and are caught in a receptacle for the purpose, while the light porous slag is carried off by the water, thus avoiding the expense of crushing and washing to which all the furnaces were subjected before the method of granulation was introduced. It is also extensively used in some parts of France and Belgium.

The extremely clean pigs made in this casting bed of granulated slag suggested its further use. The fine dust was sifted out and used to sand the moulds for fine castings. It was found that such castings were much more easily cleaned, and that the iron was quite bright. The result was a better and cleaner casting and considerable saving in the item of cleaning them.

As these uses consumed but a very small part of the slag, it was offered as ballast to the railroad companies on condition that they should remove it themselves. As the size of the grain can be easily regulated by the velocity and direction of the water, the railroad companies were not slow to avail themselves of these conditions, and soon were glad to pay for it, thus furnishing to the furnace company a revenue from what had previously been a source of expense. The granulated slag weighs 1200 k. the cubic metre. Its cost in France, where it is used, is less than half the price of sand. It is exceedingly porous, so that it retains very little moisture and yet packs sufficiently, the result is that it will bear transportation long distances, as it is much cheaper than ordinary gravel and better adapted to the purpose of ballast.

The substitution of the granulated slag for sand in construction suggested itself at the outset and its use has been attended with excellent results. It was found that some of the slag mortar which had been left over after some repairs where it had been used, became solid after a short time; this suggested its use in the preparation of concrete, and in the construction of foundation walls. A number of experiments were made to ascertain the exact nature of the sand, and it was found that 100 grammes of granulated slag digested in 100 grammes of water containing 0·15g. of lime in solution absorbed in 48 hours 0·052g., the water at the end of this time retaining only 0·098g. of lime in solution.

The manufacture of bricks from this material immediately suggested itself. Persons who have been in the habit of travelling on the Rhine will probably have noticed in the vicinity of Neuwied long rows of white bricks of all shapes, pipes, and more or less complicated pieces for building purposes, piled drying in the sun. This material is manufactured from a granulated pumice which is found here at a depth of a few inches from the surface. It is simply mixed with lime, pressed and sun dried. It is very extensively used on the Rhine and in its vicinity. It is of this material that the interior arch of the roof of Cologne Cathedral is said to be constructed. This pumice resembles the granulated slag. The proprietors of the Georg-Marien Hütte, in Hanover, adopting the suggestion, commenced the manufacture of this kind of brick from slag and are so well satisfied with it, that they use it in the place of bricks for the construction of their buildings. The bricks there, at the time of my visit, were made at some disadvantage with imperfect machinery, yet they cost much less than ordinary brick. Once out of the machine the bricks are simply sun-dried, and can be very quickly used in construction. They give a light, cheerful air to the buildings, and make a warm and exceedingly comfortable house at a very small cost. It is remarkable what can be done when the necessity exists. I saw at Kreutznach on the Rhine, and in the Siegen district bricks made from ordinary coal ashes mixed with lime and sun dried, which had stood, during several years of exposure, with no sign of deterioration. The manufacturer assured me that there were seven or eight large establishments for the manufacture of this coal ash brick in Germany.

In some parts of Europe there is a demand for bricks covered with an enameled surface. By coating the surface of the unburned brick with granulated slag and then burning it, out of the direct contact of the coal, it was found to produce an enamel of different colors varying with the composition of the slag; and it is suggested that such bricks as these can be made without any extra cost by simply replacing the ordinary sand with which the men cover the tools, to prevent the adherence of the clay, with the granulated slag sand. It might be used to advantage in the manufacture of tiles, drain pipes, and coarse pottery generally.

By mixing a certain proportion of this granulated sand with clay it was found that the articles so manufactured were capable of undergoing sudden changes of temperature without breaking. This suggested the use of a certain amount of the artificial sand in the manufacture of fire bricks; and after a certain number of preliminary assays in a blacksmith's forge, a furnace for melting brass was constructed, in making the fire bricks for which, the calcined sand was replaced by granulated slag. These bricks were quite as serviceable as any others, and underwent no alteration after three months' trial. It is proposed now, after a sufficient number of assays shall have been made, to use this material in the manufacture of bricks for the puddling furnace.

Another application of the granulated slag is its use for agricultural purposes. The important part which carbonic acid plays in rendering soluble the different mineral substances which plants require for their growth is well known. It was found that by digesting 100 grammes of granulated slag in water charged with carbonic acid for a period of forty-eight hours, 1·6 g. had been disolved. This renders it probable that it can be very profitably used on calcareous soils, while the large quantity of lime contained renders it likely that it will prove equally serviceable on siliceous soils. The very fine state of division to which it may be reduced at a very small cost is favorable to its decomposition in the soil.

Blast furnace slags gelatinise in acids and they are, therefore, very suitable for the manufacture of cement. Pelouse and Fremy in the last edition of their work on general chemistry cite them as being eminently fit for this purpose. The possibility of having them in such form as granulated slag reduces the price of the pulverized material to a sum so small, that in certain parts of Germany an artificial cement equal in every respect to the best Portland cement, is manufactured at a price so low as to yield a large

profit, and yet very much undersell it. Very large works for the manufacture of this artificial cement, are, during this year, to be constructed on the results of experiments, lasting over several years at one of the large German iron works.

Considerable attention has been paid in Belgium and Germany to the use of the slags for the manufacture of chemical products. These were first salts of alumina, then salts of lime as an incidental product, and lately the use of the silica extracted for the manufacture of soluble glass. This of course necessitates the location of the blast furnaces at some point near a large acid manufactory. It does not seem likely that this method will ever be used on a large scale in this country where material containing a much larger percentage of these substances can be had almost as cheaply as the granulated slag, which must, of course, be used to bring the manufacture of chemicals even within reach of probable profit.

In certain conditions of the furnace the slag is spun by the blast into fine fibres, and makes a substance which is sometimes called "furnace wool." This material is a very bad conductor of heat and it has recently been proposed to use it as packing, to prevent loss of heat about boilers, etc.

I have thus rapidly sketched some of the uses to which this hitherto worse than useless material may be put. But few of these are likely to find any application in this country. The manufacture of paving stone where good material for that purpose is wanting may be carried on successfully. It requires but little care, but the slags must be of very nearly constant composition, and must not change their form after cooling. The material when properly mad[e] wears well, and has been laid in some of the cities of Europe under severe tests for several years. I have a number of such blocks in the metallurgical collection of the School of Mines, taken up after seven years' use, at my request, from the streets of one the largest cities in Europe.

The manufacture of the granulated slag bricks, when wood for building purposes is cheap, is not likely to come into use. But in every case where brick or stone is to be used, it is cheaper and preferable, and the manufacture once started, it is more than likely that if such bricks will stand our severe climate, and there seems no reason why they should not wear here, as well as in the large establishments where I saw them used, they will be adopted for these constructions. The use of the slag in the place of sand will follow as a matter of course when it is granulated, and also its use for agricultural purposes.

The most valuable of all the uses, however, is that of cement. I have seen cement equal to any of the best Portland cement made at a very small cost, and this from any slag, no matter how the composition varies. The great advantage of having a suitable substance for the manufacture of cement, in such a condition, that at very small cost it can be reduced to an impalpable powder, is apparent. This manufacture of cement is not to be confounded with the adulteration of cement by slag, which is said to be carried on, on a large scale, in England. The slag, before it is manufactured, will of course deteriorate the value of the cement with which it is mixed, though it is a better adulteration than ordinary sand and may perhaps be honestly undertaken in the belief that the pulverized slag alone has some of the properties of cement. The construction of a large manufactory after several years' experiment in one of the largest works of Germany seems to be a guarantee that we may hereafter use cement in construction more freely and be able to procure at a small cost a better article than we now have.

The Mineral Resources of North Carolina.*

By F. A. GENTH.

CONTINUED FROM PAGE 291.

Before I proceed with the consideration of the numerous iron ore beds of the slates of the King's Mountain group, I will mention that north-west of the titaniferous iron ore ranges of Rockingham, Guilford, etc., Counties at least three ranges have lately been found between it and the Dan River, called the Johnny Watson, Love and McQuillan ranges. No developments have been made as yet, but the analyses of some of the ores show them to be free from titanic acid, and yielding about 50 per ct. of iron.

A very extensive and important belt of iron ores, which has furnished the greater portion of the iron ore used in the State, occurs in the slates of the King's Mountain group. It consists of a series of parallel magnetic ore beds extending, with frequent interruptions, from the neighborhood of Danbury, in Stokes County, across the entire State into South Carolina.

The character of this set of magnetic beds is so uniform that it would be tedious to enumerate all the important beds; I will therefore point out only a few of the most characteristic ones.

The ores are granular magnetites *without titanic acid*, at times quite pure, but generally in part altered into hematite, and more or less intermixed with fine grained actinolite, tremolite, talc or chlorite, and frequently associated with small quantities of epidote. The average of the ore is above 60 per cent.

A very fine bed of this granular magnetite associated with actinolite is the Rogers ore bank, near Danbury in Stokes County, which has been worked for a long time, and the ore smelted at the furnace on the Dan River.

There are several parallel ore beds; the upper is of the finest quality and most valuable. It is between seven and twenty feet in width, yielding on an average about 60 per cent. of iron. The ore is almost free from phosphorus and sulphur. Some of the smaller beds at their outcrop are rather sulphurous. Similar very fine beds occur in Surry County; the ores are schistose granular magnetites, with talcose, micaceous and quartzose admixtures.

At Tom's Creek this ore has been worked since 1795, and bloomeries are now in operation. Other ore beds, which have been extensively worked, are the William's Ore Bed, and the Hyatt's Mine.

The Southern continuation of the ore beds of Stokes and Surry are developed again in Forsyth and Yadkin Counties. The character of the granular magnetites remains the same, and is an association of talc or actinolite. They have been extensively worked at Hobson's in Yadkin County, near the east bend of the Yadkin River and other places.

Probably the beds in Davie County, on the South Yadkin River, are the same, and pass through Iredell County, near Statesville into Catawba and Lincoln Counties, where they have again been extensively worked for a long time in blast furnaces, as well as in bloomeries, producing iron of great strength and toughnesss.

In Gaston County the same beds of granular magnetite, to a great extent altered into hematite, with a fine grained actinolite slate, have been worked on the High Shoal property on the Little Catawba River, at Ellison's and Carson's Ore Banks.

Not only magnetites furnish the material for the production of iron, but also very fine limonites, fibrous, cavernous, and partly resulting from the alteration of the carbonate of iron, often yet showing its crystalline structure. They occur in large veins or beds in the slates; as they result mostly from the oxidation of pyritous ores, it may be expected that at a greater depth this will replace them entirely. The Orman and Mine Mountain and Ferguson Ore Banks, all on the High Shoal property, have been extensively worked, It is to be regretted that litigations have thus far prevented Admiral Wilkes from commencing operations at this highly valuable property, with its magnificent water power and other facilities for conducting a large manufacturing business. Near the top of Crowder's Mountain a vein of specular iron has been found. In the vicinity of King's Mountain the magnetic ores have been worked since the latter part of the eighteenth century. One of the ore beds is about forty feet thick. Besides the magnetites there are also limonites of good quality. A very striking feature of this very important and extensive belt of magnetites is its proximity to a parallel band of limestone, which accompanies the iron ore at almost every locality from Danbury down to King's Mountain.

Entering again the gneissoid rocks, we meet near Newton, in Catawba County a very valuable bed of granular magnetic iron in syenite, resembling the ore from Cranberry in Mitchell County.

Magnetites as well as hematites are found in Wilkes and Caldwell Counties, some of which were formerly manufactured into iron. One very promising outcrop of large beds of granular *titaniferous* magnetite, for instance, has been observed near the Yadkin River, one mile west of Patterson, and another two miles north of Hickory, both in Caldwell County. At the latter place there also occurs red hematites and limonites in large deposits and of excellent quality. It is probable that further developments may prove the existence of a more extensive range, since similar granular magnetites have been found near Morgantown, almost in a line with the strike of the more northern beds.

Another bed accompanies the limestone of McDowell County on both sides of the North Fork of the Catawba River; the ores are limonite, sometimes also hematite mixed with magnetite. These limonite beds continue to the west of the Blue Ridge, where we find them again overlying the limestone in Henderson and Transylvania Counties.

Several beds of limonite and occasionally hematite of good quality, exist in several localities of Buncombe County, so at Ore Mountain, two miles southwest of Swannanoa Gap, and also 4—5 miles west of Ashville.

The magnetites and hematites west of the Blue Ridge deserve the highest attention, as they are not only of very superior quality, but also found in inexhaustible quantities. The most northern bed of magnetites is found in Ash County at the North Fork of New River, near Hilton Creek. The ore is granular and talcose, in its general character almost identical with the ores of the King's Mountain range, being granular magnetites of somewhat slaty structure from the intermixture of small quantities of talc. The ores have been worked in bloomeries and have yielded a good quality of iron.

A very superior ore occurs at Cook's Gap, in Watauga County. It consists of an almost pure stratified red hematite, with octahedral crystals [of magnetite disseminated through the mass. It is associated with limonite. It is an ore worthy of fuller investigation.

A number of iron ore beds are found in Mitchell County; the most valuable deposits are about one and a half miles south of Cranberry, near the Tennessee line. The ore beds have not been sufficiently explored to show their geological character and size, but they appear to be inclosed betweeen hornblende slates and a peculiar micaceous slate.

The size of this ore bed must be enormous; judging from the out-crops it may have a width of 300—400 yards, and extends for more than half a mile; the whole side of the hill is covered with large blocks of the finest quality of magnetite, which evidently exists there in inexhaustible quantities.

The magnetite is often quite pure and polaric, coarse-grained, sometimes crystallized in octahedra, and associated with pyroxene and epidote. The pyroxene weathers into a brown ferruginous clay, in which are inclosed grains of magnetite. As these ores are soft and require little labor, they are the *only* ones worked and converted into blooms, at the works about two miles distant. The whole production is not over one ton of blooms a day. The finest quality is not touched. The analysis of a specimen representing about the average of the ore, showed it to be entirely free from sulphur and phosphorus, and containing 65 per cent. of iron.

TO BE CONTINUED.

* From the Journal of the Franklin Institute.

THE COAL TRADE.

NEW YORK, May 10, 1872.

Anthracite Coals.

WHOLESALE.—There is little that is interesting, though much that is instructive, in the present situation of the coal trade. The anthracite business presents the natural results of an ill-regulated and excessive production. Schuylkill coal, for instance, is continually "shoved" into this market from Philadelphia, and sold for what it will bring. The nominal prices given in our tables are not therefore rigidly maintained. Schuylkill stove, for instance, quoted at $5.50 for red ash and $5 for white ash, has sold during the week as low as $4 to 4 50 for the latter and $4.50 to $5 for the former. Under such circumstances, trade is naturally demoralized. By reference to our table of transportation, it will be seen that the production this year is already more than three million tons in excess of the last—a fact which is not encouraging for the immediate future of the anthracite trade. The recent rumors of another strike in the Lehigh region appear to be without foundation. At least the matter has blown over. A strike would be a welcome occurrence to many operators, who might then hope to dispose of their larger surplus stocks at somewhat advanced prices.

Bituminous Coals.

The bituminous trade, on the other hand, is extremely strong. Only the lack of vessels limits the sale of these coals, for which orders are large and continuous. The principal consumption is of course that of the ocean steamers, which have largely used bituminous coal ever since it proved its superiority as a steam fuel in the memorable contest between the COLLINS and CUNARD lines. There is considerable demand for metallurgical purposes also—not only in iron but also in gold and silver, for the production of which there are works in Newark and on the North river.

The healthy commercial condition of the bituminous trade is largely due to the fact that the companies do not accumulate larger stocks beyond the certain prospects of sale, but regulate their production by their orders.

Our tables of freights, which show many important changes indicate a general decline, in consequence doubtless of the dullness of the anthracite trade. In railway freights, the strange alteration in rates per Belvidere and Delaware deserves notice. Hitherto, the cost of transportation from Mauch Chunk to South Amboy has been pretty regularly 15 cents per ton less than to Hoboken, Port Johnston or Elizabeth. Our last quotations were $1.99 to these points, and $1.84 to South Amboy. By the May circular of the L.V.RR., it appears that the price to S. Amboy is $1.98 (including shipping expenses) or only one cent less than to Hoboken. The change is not between Mauch Chunk and Phillipsburgh, but between this point and tide-water. What it means no one appears to exactly understand. By the circular alluded to, the rates from Penn Haven are, in all cases but one, 12 cents more than from Mauch Chunk; but in this one (to South Amboy) they are 15 cents more—another anomaly, which attracts some curiosity. Will the Lehigh Valley rise to explain?

Anthracite Coal Trade for 1871 and 1872.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending May 4, 1872, compared with the week ending May 6, 1871.

COMPANIES.	1871. WEEK.	1871. TOTAL.	1872. WEEK.	1872. TOTAL.
*Phila & Reading R.R†	39,053	941,876	128,240	1,661,561
Schuylkill Canal	10,506	76,709	31,653	161,395
Lehigh Valley R. R.	13,411	456,218	68,106	1,223,024
Lehigh & Sus. R. R.	18,835	154,670	34,297	516,788
Lehigh Canal	1,704	5,338	25,366	76,101
Scranton North	15,518	26,038	10,369	192,219
" South			49,069	67,291
Penn. Coal Co., rail	44	3,611	30,931	373,220
" " " canal				356
Del. & Hud. Canal Co.		4,660	46,361	125,111
" East	23	52,560	14,534	216,966
" " West		12,720	6,415	111,204
" " South			4,457	111,596
Shamokin	14,205	203,399	8,669	141,143
Trevorton				
Lykens Valley Coal Co.	2,319	23,280		2,590
Wyoming South				
Wyoming North				
P. N. Y. C. & R. R. Co.	118	35,437	12,938	223,810
Williamstown Col'y		17,847		
Big Lick Col	3,512	36,270		10,591
Total	119,390	2,050,704	476,027	5,823,346
1870			119,390	2,050,704
Decrease				
Increase			356,637	3,773,142

* These figures are for the week and fiscal period commencing Nov. 30

† Less coal transported for Co's use and Bituminous coal.

Bituminous Coal Trade, 1871 and 1872.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending May 4, 1872, compared with week ending May 6, 1871.

COMPANIES.	1871. Week.	1871. Year.	1872. Week.	1872. Year.
C. & O. Canal	20,707	148,824	18,900	118,195
B. & O. R. R.	30,503	374,545	29,086	385,571
H. & B. T. R. R.	8,569	120,190	6,878	94,818
*Harrisburg & D	16,519	199,571	9,101	201,001
*L. V. R. R.	....	23,325	724	12,218
P. & N.Y.C. & R. Co.	6,343	99,928	7,201	134,858
Cumberl'd Branch Canal	5,919	45,378	6,461	45,378
" Railroad	1,822	26,072	675	3,648
Total	90,382	1,037,533	79,026	995,587
	79,026	995,687		
Decrease	11,356	41,846		
Increase				

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, May 4, 1872.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	27,253	01
" Port Carbon	6,566	12
" Pottsville	2,641	09
" Schuylkill Haven	27,859	12
" Pine Grove	6,408	13
" Tamaqua	13,066	19
" Harrisburg		
" Dauphin	4,391	09
Total	88,186	15

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	11,046	15
" Mill Creek "	2,495	05
" Schuylkill Valley Scales	1,416	15
" Mt. Carbon "	802	03
" Cressona "	10,656	19
" Pine Grove "		
" Tamaqua "	1,846	06
Total	28,264	03

SHIPPED WESTWARD VIA NORTHERN CENTRAL RAILROAD.

Passing Locust Gap	2,673	16
" Shamokin	3,178	01
" Herndon	.....	
Total	5,851	17

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	1,081	09
" Lebanon & Pine Grove Branch	1,109	12
Total	2,191	01

CONSUMED ON LATERALS.

From Frackville Scales	648	08
" Mill Creek "	538	04
" Schuylkill Valley Scales	475	13
" Mt. Carbon "	266	03
" Cressona "	150	14
" Pine Grove "	350	17
" Tamaqua "	265	12
Total	2,695	11

LEHIGH AND WYOMING COAL.

Received via Allentown, E. Penn'a Br.	51	00
" " Alburtis, " "	21	02
" " Oreland, G. & N. Br.	477	18
" " Connecting R. R.	.....	
" " Willow Street R. R.	490	15
Total	1,040	15

BITUMINOUS.

From Harrisburg	9,090	14
" Connecting R. R., G. & N. Br.		
" Junction R. R.	10	00
Total	9,100	14

COAL FOR COMPANY'S USE.

Anthracite	8,552	18
Bituminous	192	04
Total	8,745	02

RECAPITULATION

	Total for Week.	Corresp'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	88,186 15	19,088 11	i 69,098 04
For Shipment by Canal	28,264 03	8,509 08	i 19,754 15
Shipped Westward via Northern Central R. R.	5,851 17	8,124 19	d 2,273 02
Shipped West or South from Pine Grove	2,191 01	1,259 09	i 931 12
Consumed on Laterals	2,695 11	2,070 14	d 624 17
Lehigh and Wyoming Coal	1,040 15		i 1,040 15
Total Anthracite paying freig't	128,239 02	39,053 01	i 89,177 01
Bituminous	9,160 14	16,519 05	d 7,418 11
Total of all kinds paying freig't	137,399 16	55,572 06	i 81,758 10
Coal for Company's use	8,745 02	4,156 15	i 4,588 07
Total Tonnage for Week	146,075 18	59,729 01	i 86,346 17
Previously this year	1826320 17	1173187 15	i 653,133 02
Total to date	1972396 15	1232916 16	i 739,479 19

SHIPPED BY CANAL.

From Schuylkill Haven	29,709 10	7,681 05	i 22,028 05
" Port Clinton	1,944 00	3,878 00	d 1,934 00
Total Tonnage per Week	31,653 10	11,559 05	i 20,094 05
Previously this year	129,631 09	69,947 12	i 59,683 17
Total to date	161,284 19	81,506 17	i 79,778 02

Schuylkill Canal.

Report of coal transported over the Schuylkill Canal for the week ending Saturday, May 4, 1872.

	Tons.	Cwt.
From Schuylkill Haven	29,709	10
" Port Clinton	1,944	00
Total for week	31,653	10
Previously this year	129,631	09
Total	161,284	19
To same time last year	82,749	17

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, May 4, 1872.

	WEEK.	SEASON.
North	55,479 07	833,490 19
South	4,457 11	116,596 02
Total 1872	59,936 18	950,087 01
Corresponding time in 1871:		
North	Suspension.	
South	"	
Total		
Increase North		
Decrease North		
Increase South		
Decrease South		
Total decrease 1872		
Total increase 1872	59,936 18	950,087 01

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, April 27th, 1872.

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	10,369 05	192 218 14
Shipped South	49,069 09	673,290 11
Total	59,438 14	865,590 05
For the Corresponding time last Year:		
Shipped North	.....	.....
Shipped South	.....	.....
Total	7,759 03	13,019 05
Increase	51,679 11	852,490 00

Coal transported on the Delaware, Lackawanna and Western R. R., for week ending May 4, 1872:

	Week. Tons. Cwt.	Year. Tons. Cwt.
Shipped North	11,789 02	204,007 16
Shipped South	46,858 18	720,149 09
Total	58,648 00	924,157 05
For the corresponding time last year:		
Shipped North		
Shipped South		
Total	15,518 06	26,038 10
Increase	43,129 14	898,118 15
Decrease	.....	.....

Delaware and Hudson Canal Company.

The following is a statement of Coal Transported by the Delaware and Hudson Canal Co. for the week ending May, 4 1872.

	FOR THE WEEK.	FOR THE SEASON.
By Delaware and Hudson Canal,	46,361	125,111
By Railroad, East	14,534	216,966
" " West	6,415	111,204
" " South	4,457	116,596
Total Tons	71,767	569,877
For the same period last year.		

	FOR THE WEEK	FOR THE SEASON.
By Delaware and Hudson Canal,		4,660
By Railroad, East	23	52,560
" " West		12,720
" " South		
Total Tons	23	69,940
Increase		499,937

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending May 4, 1872, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	11578 06	208,054 00
" Hazleton	50798 10	821,871 18
" Upper Lehigh	21 15	1,213 12
" Beaver Meadow	19,959 05	310,121 11
" Mahanoy	10,825 08	119,488 05
" Mauch Chunk	62 17	1,464 06
Total	93,286 01	1,452193 12
Same time last year	14,562 01	517,834 04
Increase	78,724 00	934,359 08
Decrease		
Forwarded East from Mauch Chunk by rail	68,108 01	1,223,923 13
Same time last year	13,491 01	458,217 16
Increase	54,697 00	764,205 17
Decrease		

DISTRIBUTED AS FOLLOWS.

Forwarded East from Mauch Chunk by rail	67,594 04	1,201,365 14
do East for use L. V. R. R.	513 17	21,657 19
Delivered at and above Mauch Chunk for use of L. V. R. R.	1,095 05	25,168 05
To P. & N. Y. R. R.	8,092 09	128,024 02
To N. C. R. R., at Mount Carmel		677 13
To D. H & W. R. R.	896 15	11,499 10
To L. & S. R. R. at Packerton for rail	160 07	6,186 00
Delivered at M'h Chunk	22 16	809 06
Delivered on line of road above Mauch Chunk	175 00	9,210 16
To L. & S. R. R., at Penn Hav., for railroad		3,960 07
Do. for canal	9,419 06	25,870 17
To Lehigh Canal Mauch Chunk	5,022 06	14,826 15
To Catawisa Railroad	284 16	2,847 16
Total	93,286 01	1,452,193 12

Shamokin Coal Trade.

For week ending May 4, 1872	3,669 08
Same time last year	14,225 08
Increase	
Decrease	5,556 00
Total amount shipped to date	144,142 14
Same time last year	203,398 14
Increase	
Decrease	59,156 00

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending May 4, 1872.

	Week. Tons.	Cwt.	Total. Tons.	Cwt.
Anthracite received :				
From Lehigh Valley R. R.	8,092	09	128,023	02
" Lack. & B. R.R.	1,532	11	31,923	07
" Pleasant Valley R. R.	2 221	06	40,855	03
" Sul. & Erie R. R.	1,091	09	23,008	12
Total	12,937	15	223,810	04
Distributed :				
To Lehigh Valley R. R.	1,140	06	22,018	16
To Lack. & B. R. R.			1 017	17
To S. Central R. R	4 368	03	45,093	09
To Ithaca & A. R. R.	1.767	11	47,717	17
To Erie R. W. Pockets for shipm't.	5,069	09	68,619	03
To individuals on line of road	61	01	11,701	19
To points at & above Coxton for use of Co.	403	08	10,636	16
To points between Waverley and Elmira	127	17	17,004	07
Total	12,937	15	223,810	04
Bituminous :				
Received from Barclay R. R.				
Shipped North from Towanda	7,118	13	133,763	18
Shipped South from Towanda	82	06	1,002	18
Northern Central R. R.			91	01
Total	7,200	19	134,857	17
Distributed :				
To Erie R. R.	6,761	11	119,028	15
To So. Central R. R.	357	02	14,583	08
To Ithaca & A. R. R.			21	15
To Lehigh Valley R. R.	6	00	796	02
To individuals on line of R R.	25	00	288	11
To points on line of road for use of Company	51	06	139	06
Total	7,200	19	134,857	17

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending May 4—Compared with same time last year.

WHERE SHIPPED FROM	WEEK 1872., tons ct	WEEK 1871. tons ct.	YEAR 1872 tons cwt.	YEAR 1871, ons.cwt.
Wyoming Region	33478 16	29878 12	406313 15	150516 13
Upper Lehigh Region	2960 16		65360 08	4614 06
Beaver Meadow Region				
Hazleton Region	9764 07	449 06	30638 07	1695 16
Mahanoy Region				
Treseckow Region	4143 15		32943 08	1043 03
Mauch Chunk Region	8122 05	406 18	132119 17	21165 14
Totals	58469 19	21725 16	656475 15	179035 12
Increase	36744 03		477440 03	
Decrease				
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	38986 19	18836 00	516788 09	152670 05
Forwarded East of Mch Chunk by Canal	14309 02	1675 12	44587 12	4437 18
Delivered at and above Mauch Chunk	913 19	1156 04	21641 14	19192 08
L. V. R. R at Packer'n	259 16	58 00	5359 03	2735 01
Delivered to L. & B. R. R.at Plymouth Bridge	4000 03		68098 17	
Totals				
Of the above there was transported on acc'nt of L. C. & N. Co.	12396 19	476 18	155027 18	22402 01
W.-B. C. & L. Co.	24610 01	19746 00	290365 06	126300 08
Totals	37307 00	20152 18	445393 04	148702 09
Increase	17154 02		296639 15	
Decrease				

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday May 4, and during the year 1872, compared with the corresponding period of 1871.

WEEK.

	To C. & O. Canal Tons.	Cwt.	To B. & O. R.R. C. Tons.	Cwt.	Total. Tons.	Cwt.
1872	18,900	10	29,085	18	47,986	18
1871	20,707	09	30,503	07	51,210	16
Increase						
Decrease	1,806	19	1,417	09	3,224	08

YEAR.

1872	118,195	01	385,571	04	503,766	05
1871	148,824	10	374,545	01	523,369	11
Increase			11,026	03		
Decrease	30,629	09			19,603	06

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons.	Cwt.	To B.&O.R.R. Co Tons	Cwt.	Total. Tons.	Cwt.
1872	6,460	11	675	03	7,135	14
1871	5,918	17	1,822	02	7,740	19
Increase	541	14				
Decrease			1,146	19	605	05

YEAR.

1872	39,302	16	3,648	02	42,950	18
1871	48,378	02	26,072	05	71,450	07
Increase						
Decrease	6,075	06	22,424	03	28,499	09

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending May 4, 1872.

	1872. WEEK.	YEAR.	1871. WEEK.	YEAR.
By Railway	30,930 13	373,220 06	44 06	3,610 14
" Canal		355 11		
Total	30,930 13	373,575 17	44 06	3,610 14
Increase 1872.	369,965 03			

Lehigh Canal Coal Trade.

Shipped for the week ending May 3, 1872.

	Week. Tons.	Cwt.	Week. Tons.	Cwt.
Total from Mauch Chunk Region	7,696	01	28,342	00
" " Beaver Meadow "	4,460	05	13,371	01
" " Treseckow "	979	05	2,707	07
" " Mahanoy "	663	04	1,535	03
" " Hazleton "	9,519	04	25,405	00
" " Upper Lehigh "	1,153	12	2,909	08
" " Wyoming "	854	11	1,831	03
Total	25,306	02	76,101	02
Corresponding week last year	1,703	14	5,337	16
Increase	23,602	08	70,763	06
Decrease				

Lehigh Coal and Navigation Company,

Report of Coal transported over the Lehigh Canal and L. & S., Div. of Central Railroad of New Jersey for the week ending May 4, 1872, and for the year 1872.

	WEEK.	YEAR.
Forwarded East of Mauch Chunk by Rail	38,986	516,788
Delivered at and above do.,	913	21,641
Forwarded East of do., by Canal	25,406	76.101
	65,297	614,531
Corresponding period last year—		
Forwarded East of Mauch Chunk by Rail	18,836	152,670
Delivered at and above do.,	1,156	19,192
Forwarded East of do., by Canal	1,703	5,733
	21,695	177.200
Increase on Railroad	19.908	366,567
Decrease " "		
Increase on Canal	23,602	
Decrease " "		70,763
Of the above there was transported on account of—		
Lehigh Coal Nav. Co	20,393	183,369
Wilkesbarre Coal & Iron Co	24,610	290,365
	45,003	473,735
Corresponding period last year—		
Lehigh Coal Nav. Co	499	22,682
Wilkesbarre Coal & Iron Co	19,746	126 300
	20 245	148,983
Increase	24,757	324,752
Decrease		

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

	AT NEW YORK. May 10. R. A.	W. A.	AT PHILADELPHIA. May 10. R. A.	W. A.
SCHUYLKILL.				
Lump	$— —	$— —	— —	— —
Steamer,	— —	— —	— —	— —
Broken,	— —	— —	— —	— —
Egg	5 25	4 75	— —	— —
Stove	5 50	5 00	— —	— —
Chestnut,	4 25	—	— —	— —
Pea	— —	— —	— —	— —
LEHIGH.				
Lump, (along side)	5 00	—	— —	— —
Broken	4 75	— —	— —	— —
Egg	4 50	— —	— —	— —
Stove	5 25	— —	— —	— —
Chestnut	4 25	— —	— —	— —
Pea	— —	— —	— —	— —
SPECIAL COALS.*				
Honey Brook, Lo'h	W. A. 4 00@4 75		— —	— —
Spring Mountain	" " — —@—		— —	— —
Sugar Creek	" " — —@—		— —	— —
Sugar Loaf	" " — —@—		— —	— —
Old Comp'y's	" " 4 00@4 75		— —	— —
Room Run	" 4 00@4 75		— —	— —
McNeal	" " — —		— —	— —
Girardville	" " —		—	—
Hill & Harris	" " — —		3 10@4 00	—
Shamokin	" " — —		— —	— —
Lykens Valley	" " — —		— —	— —
Broad Top	" " — —		— —	— —
McMichael	" " — —		3 25@4 25	— —
Henry Clay	" " — —		— —	— —
Powelton	" " — —		— —	— —

Dealers in these coals may be found in our advertising columns.

Company Coals.

May, 1872.

	L.	Str.	Gra	Eg.	Sto	Chest
*Scranton at E. Port	3 47	3 53	3 60	3 63	4 49	3 58
*Pittston at Newburg	3 90	3 90	4 00	4 10	4 25	4 00
*Lackawana at Weehawken	3 75	3 75	3 85	3 85	4 25	3 75
Wilk'b're at Hoboken	3 75	3 75	3 85	3 85	4 35	3 80
Old Co. Lehigh at Pt John'n	5 15	—	4 35	4 35	4 60	4 60
Lehigh at Eliz. Port	5 00	—	4 25	4 25	4 50	4 00

For freights to different points see "Freights."
* to contractors only.

Bituminous Coals (Cumberland).

Georgetown, F.o.b.	$4.25
Baltimore	4.70
New York	6.75

Prices of Gas Coals.

May, 1872.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr.,41-43 Pine st., N. Y

Duty, $1 25, gold

	Coarse	Slack.
Rock House	$1 60 @-1 75	
Sowrie	1 60 @-1 75	

Corrected by Bird, Perkins & Job, 86 South street.

	Coarse.	Culm of Coal.
Pictou	$2 25 @1 25	
Sydney	25 @- 80	
Lingan	1 60 @- 80	
Little Glace Bay	1 60 @1 00	
Caledonia	1 60 @- 80	

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty $1 25 per ton, gold, on the coarse coal. 25 per cent. ad valorem on the Culm of Coal

AMERICAN.

	Currency.
Westmoreland	$7 00 @- —
Fairmount Gas Coal Co. of N. Y.	7 00 @- —
Despard Coal Co.	7 00 @- —
Penn.	7 00 @- —
Newburg Orrel Gas	— — @- —
West Fairmount Gas Coal	7 00 @- —

AT PHILADELPHIA.

Powelton	$6 75

TO NEW YORK.

Provincial	
Sidney	$3 25
Lingan	3 25
Cow Bay	3 37½
Port Caledonia	3 37½
Little Glace Bay	3 25

Prices of Foreign Coals.

May, 1872.

Duty $1 25 per ton.

Corrected weekly by PARMELE BROS., No 32 Pine street, N. Y.

Liverpool Gas Caking	$ 8 00@— —
" " Cannel	12 00@13 00
" House "	18 00@20 00
" Orrel.	14 00@16 00

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$16 00@17 50
"Cannel, "	20 00@25 00

Per ton 2,000 lbs. delivered.

Freights.—May, 1872.

TO EASTERN PORTS.	Cumberland. From Georgetown.	From Baltimore.	Anthracite. From Philadelp'a.	From Elizabethport, Port Johnson, and Hoboken.	From Newburg	From Rondout
Amesbury				2 95		
Bangor	3 75	3 25		1 75		
Bath	3 50	3 25				
Boston	3 50	3 00	3 75	2 00		2 90
Bridgeport	2 75	2 70		1 60		1 25
Bristol	2 75			1 60		1 85
Derby	3 25			1 20		
Dighton	3 00	2 75				
East Cambridge				2 00		1 85
Fall River	2 75	2 75		1 60		
Hackensack						
Hartford	3 50			1 50		1 75
Hoboken	2 20					
Jersey City	2 20	2 00		50		
Middletown						1 50
Mystic				1 35		
New Bedford	3 00	3 00		1 60		1 85
Newburyport		3 25		2 15		3 10
New Haven	2 75	2 50		1 00		
New London	3 00	2 75		1 30		1 25
Newport				1 60		1 60
New York	2 30	1 90		50		65
Norwalk		2 75		1 00		1 25
Norwich	3 15	2 75		1 40		1 60
Pawtucket	3 85			1 70		1 95
Portland		3 00				3 10
Portsmouth, N.H	3 85	3 25				
Providence	2 75	2 75		1 50		1 85
Rockport						
Saco						
Sag Harbor		3 75		1 30		
Salem		3 00		2 00		2 20
Stamford						
Stonington				1 20		1 65
Taunton				2 00		
Warren				1 60		
Washington						
TO RIVER PORTS.						
Albany					55	
Catskill					50	
Cocksackie					50	
Coeyman's					65	
Cold Spring					20	
Fishkill					20	
Haverstraw					40	
Hudson					40	
New York						
Nyack					45	
Poughkeepsie					50	
Rhinebeck					30	
Rondout						
Saugerties					40	
Sing Sing					50	
Stuyvesant						
Tarrytown					50	
Troy					75	
West Point					20	
Yonkers					50	

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven for consumption ($1 85 less 55c drawback	$1 30
For reshipment	1 75

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 66
C. R. R., N. J., Phillipsburgh to Elizabethport	0 98
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$1 99

MAUCH CHUNK TO PORT JOHNSON.

L. V. R.R., or L. & S. R.R. from M. C. to Phillipsb'g	$0 66
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	0 98
Shipping expenses	25
Wharfage	10
Total	$1 99

TO HOBOKEN.

L. V. R. R., Mauch Chunk to Phillipsburgh	66
Morris & Essex R. R. Phillipsburgh to Hoboken	0 98
Shipping expenses	25
Wharfage	10
Total	$1 99

TO SOUTH AMBOY.

L. V. R. R.	66
B. & D. R. R.	97
Cam. & Am R. R.	
Shipping Expenses,	35
Total	$ 198

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	0 78
C. RR. of N. J. Phillipsburgh to Elizabethport	0 98
Shipping expenses	25
Wharfage	10
Total	$ 1 12

MARKET REVIEW.

FOR THE WEEK ENDING MAY 8, 1872.

IRON.—The Iron market generally is firmer for all descriptions, with an increase of business, and somewhat improved prices. Scotch Pig still continues in light stock, and quotations are rather nominal; we note sales of small lots Gartsherrie at $52a53; 500 tons Eglinton, from ship and yard, $50a52.50; 100 do. Glengarnock, and 300 do. No. 1, to arrive, on private terms. American is scarce, and deliveries of some furnaces are made with difficulty; we quote No. 1 $50a52, No. 2 ex and Forge $49a51, and No. 2 Gray Forge $48a50, with sales of 400 tons Gray Forge at furnace, and 500 do. No. 2 ex and Gray Forge, on terms kept private. Scrap is in better demand, and the market is somewhat firmer; 250 tons, from yard, sold at $64.50 currency; and 500 do., here and to arrive, on private terms. Rails are also firmer, and we note sales of 2a3000 tons new Double-Headed at $74a75, and 50 do. Welsh $75—both gold. Refined Bar from store continues firm at our figures, and a further advance is threatened by the Philadelphia Mills.

Import of Iron into New York, from Jan. 1 to April 30, 1872—

	Bar.	Pig.	Sheet, &c.
From Foreign Ports	tons.5,488	tons.18,239	bdls.112,996
Coastwise			366
Total	tons.5,488	tons.18,239	bdls.113,362
Same time, 1871		19,926	99,314

PHILADELPHIA, May 6.—(From Circular of EDWARD SAMUEL.)—Sales are reported of Iron at prices ranging from $2 to $3 below quotations, all from second hands, producers being firm at quoted prices. Sales of new Rails are reported at $90 at will for 56 lb. T. A further adance in Merchant Bars is expected next week. Old Rails and Wrought Scrap are offered lower. Closing prices American No. 1 Foundry Pig at furnace $49a50, No. 2 $48a49, No. 3 Forge $46a47, No. 4 White and Mottled $41a44, American Refined Bar (mill price) $103-04 or 4.6 cents. Common Bar (mill price) $90a95, and Rails (at mill) $90a$95.

LEAD—Advices per cable announce an advance in England, and the market here is still firmer, 6¾a6¾ cents gold being now generally asked for ordinary Foreign, though the Government is selling at lower rates, having disposed of 300 tons since our last at 6¼ cents gold. We notice besides 100 tons ordinary German at 6½ cents, and 100 do. Refined 7, gold. Bar has been advanced to 8¾ cents and Sheet and Pipe to 10½—Tin-lined Pipe is steady at 15, all less 10 per cent. to the Trade, being ¼ cent higher on Bar, and ½ a cent on Sheet and Pipe Block Tin Pipe 65 cents.

Import of Lead into New York, from Jan 1 to April 30 1871—

From Foreign Ports	pigs. 144,706
Costwise Ports	22,119
Total	pigs. 166,825
Same time, 1871	194,295

COPPER—New Sheathing is still quoted 46 cents, and Bolts and Braziers' 48 Bronze and Yellow Metal Sheathing 30, and Y. M. Bolts 32. The market for Ingot is at a stand, buyers holding off as much as possible pending receipts from the Lake region due within the next four or five weeks: we have only to notice sales of about 50,000 lb. Lake, in lots, at 39a40 cents; for Summer delivery 35 cents is asked, and English is held at 33a34 for Best Selected. At the close cash Copper was a little firmer, consequent upon reports from England per cable of an advance there of £6a£7.

STEEL—The market is steady and firm at our quotations, with a fair demand—a lot of 4500 lb. English Cast Spring sold at 20 cents currency.

SPELTER—Remains quiet. Stocks of Foreign are held firmly at 7¼ cents gold on the spot, and 7a7¼ to arrive.

Import of Spelter into New York, Jan 1 to April 30—

1872.....plates. 132,692; 1871.....,plates.82,714

TIN.—There is a continued absence of demand for Pig, and prices remain nominal at 40 cents for Straits and English; 100 slabs Straits sold on private terms. Plates, too, have become comparatively inactive; prices, however, are sustained, though there is not that buoyancy which has been so marked a feature of the market during the past two months or more. Sales have been made of 1000 bxs. Charcoal Tin at $13.75; 1000 do. Charcoal Terne, $12,25 gold; and 500 do. Coke Tin, 14 by 20, on private terms.

Import of Tin into New York, from Jan. 1 to April 30—

	1872.	1871.
PIGS	No.33,093	26,043
PLATES	bxs.345,127	313,578

ZINC is quiet as per our quotations:

AMERICAN ZINC	9½a10
FRENCH "	gold 10
" " Metallic	11c.
MANGANESE	4½a5

The following is the metal circular of Messrs. VIVIAN, YOUNGER & BOND, dated London April 19, 1872.

There is not much of interest to report in the Metal Trade this week. In some articles a large business has been reported, but as a rule prices are but barely supported.

COPPER.—Some enormous orders have been given out by speculators, but to the surprise of most people interested, these orders, which we estimate at over 5000 tons, have been executed, and yet prices are rather lower than at the date of our last Circular. The fact appears to be that existing rates interfere with new orders being given out for Manufactured Copper and Brass, and at the same time the quantity of Copper offered from outside sources is considerably increased. But the speculative element is as strong as ever, and of course if the speculators can secure all the Copper in stock and hold it, the new supplies coming forward will scarcely be enough to meet the current demand, and should the orders for America continue, and French consumers and Indian shippers come in as buyers, then Copper bought at present prices will doubtless do some good for the holders.

TIN.—There has not been much change in prices since the Banca sale, nor has the business done been large. Small orders come in daily for all descriptions, and it does not look at present as if we are to have any great fluctations either way.

TIN PLATES.—Makers are very full of work, and for decent delivery high prices are obtainable, but for very forward delivery it is difficult to make sales.

IRON.—Trade is still brisk, and prices continue very firm.

SPELTER.—The price has not suffered much alteration, but the market is very firm.

LEAD.—This article is in good demand, and values appear likely to go much higher.

METALS.

NEW YORK, May 8, 1872.

IRON.—Duty: Bars, 1 to 1½ cents ₱ lb; Railroad, 70 cents ₱ 100 lbs.; Boiler and Plate, 1½ cents ₱ lb; Sheet, Band, Hoop, and Scroll, 1¾ to 1¾ cents ₱ lb; Pig, $7 ₱ ton; Polished Sheet, 3 cts. ₱ lb; Galvanized 2½; Scrap Cast, $6; Scrap Wrought, $8 per ton.

	Store Prices.
Pig, Scotch No. 1, ₱ ton	49 00@53 00
Pig, American, No. 1	50 00@52 —
Pig, American, No. 2	49 00@51 —
Pig, American, Forge	48 00@50 00
Bar Refined, English and American	— —@105 00
Bar Swedes, assorted size (ot)	— —@100 00
	Store Prices, Cash.
Bar, Swedes	125 00@135 00
Bar, Refined, ¾ to 2 in. rd. & sq. 1 to 6 in. x ⅜ to 1 in.	110 00@— —
Bar, Refined, 1⅛ to 6 by ⅛ & 5:16 & 2⅛ to 2⅞ rnd. sq..	115 00@— —
Bar, Refined, 1 & 1⅛ by ¼ & 5:16	117 50@— —
Large Rounds	122 50@127 50
Scroll	122 50@152 50
Ovals and half-round	127 50@137 50
Band	— —@122 50
Horse Shoe	120 00@130 00
Rods, ⅜ to 3-16 inch	115 00@155 00
Hoop	135 00@177 50
Nail rod	8 @— —
Sheet, Russia, as to assortment (gold)	— 18 ½
Sheet, Singles, D. and T. Common	—6½@— 7¾
Sheet, D. and T. Charcoal	—7½@— 8½
Sheet, Galv'd, Nos. 10 to 27, list 10 per cent discount	—@— —
" " Nos. 28, and 29.	—@— —
Rails, English (gold), ₱ ton	74@75 00
Rails, American, at Works in Pa.	83@85 00

COPPER.—Duty: Pig, Bar, and Ingot, 5; old Copper 4 cents ₱ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ₱ lb	— @— 46
Copper Bolts	— @— 48
Copper Braziers, 16oz. and over	— @— 48
Copper Nails	— @— 51
Copper, Old Sheathing, &c. mixed lots	— @— —
Copper, Old, for chemical purposes, 14@16 oz.	— @— —
Copper English Pig	33 @— 34
Copper, American Ingot	39 @— 40
Yellow Metal, New Sheathing & Bronze	— @— 30
Yellow Metal Bolts	— @— 32
Yellow Metal Nails	30 @— 32

LEAD.—Duty: Pig, $2 ₱ 100 lbs.; old Lead, 1½ cents ₱ lb; Pipe and Sheet, 2½ cents ₱ lb.

Galena, ₱ 100 lbs	$— @— —
Spanish (gold)	6 62½@6 75
German, do.	6 62½@6 75
English do.	6 62½@7 00
Bar (net)	8 75 @— —
Pipe (net)	— — @10 50
Sheet	— — @10 50

Colwell, Shaw & Willard Tin-Lined Lead Pipe 15 cts. ₱ lb.

STEEL.—Duty: Bars and Ingots, valued at 7 cents ₱ lb or under, 2¼ cents; over 7 cents and not above 11, 3 cents ₱ lb; over 11 cents, 3½ cents ₱ lb, and 10 ₱ cent ad val. Store prices.

English Cast (2d and 1st quality) ₱ lb	— 16¼@— 18½
English Spring (2d and 1st quality)	— 7½@— 10½
English Blister (2d and 1st quality)	— 10¾@— 17½
English Machinery	— 11½@— 13½
English German (2d and 1st quality)	— 10½@— 12
American Blister "Black Diamond"	— —@— 12
American, Cast, Tool do.	— 15 @— 16
American, Spring, do.	— 9 @— 11
American Machinery do.	— 10 @— 10½
American German, do.	— 9 @— 11

TIN.—Duty: Pig, Bars, and Blocks, 15 ₱ cent. ad val.; Plate and Sheets and Terne Plates, 25 ₱ cent.; Roofing 25. ad val.

	Gold ₱ lb.
Banca	— @50
Straits	— @40
English	— @40

PLATES.

Fair to Good Brands.	*Gold.*	*Currency.*
I. C. Charcoal, ₱ box	$14 00 @— —	$15 50 @16 00
I.C. Coke	12 50 @13 50	14 00 @15 00
Coke Terne	10 75 @11 25	12 00 @12 50
Charcoal Terne	12 50 @13 00	14 00 @14 75

SPELTER—Duty: In Pigs, Bars & Plates, $1.50 p. 100 lb

Plates, Foreign (gold) p. 100 lb.	7 12½@ 7 37½
Plates, Domestic p lb.	— 7 @— 11

ZINC—Duty: Pig or Block, $1.50 per 100 lb.; Sheet 2½c. per lb

Sheet per lb.	— 10½@— 11

San Francisco Stock Market.

BY TELEGRAPH.

The following report from the San Francisco Mining Stock Board is dated the 7th inst. With the exception of an advance of $360 per share in Crown Point, and also of $85 per share in Kentuck, the list has materially declined. Advices dated the 8th inst. states that a panic prevails in the Stock Board, and that without exception the market is weaker, Belcher having declined $300 within the twenty-four hours; we append the two reports which exhibit the changes which one day brings forth in the San Francisco Mining Stock Board:

		May 7.	May 8.
Savage	—	515	490
Crown Point	—	1825	—
Yellow Jacket	—	235	195
Kentuck	—	545	475
Chollar Potosi	—	172	147
Gould & Curry	—	400	—
Belcher	—	1300	1000
Imperial	—	300	295
Hale & Norcross	—	—	—
Eureka G. V.	—	18	—
Ophir	—	—	78
Alpha	—	—	75
Raymond & Ely	—	—	—

Mining Stocks.

NEW YORK, May 8, 1872.

With the exception of a decided advance in Gunnell, the Mining Stock list is nominally unchanged—Copper Stocks are quoted as follows: Flint Steel River $2,00; Mendota $2,50; Minnesota $6,00; Hamilton "Lead" $1.00; the following is the report:

	BID.	ASKED.
American Flag	30	55
Bates & Baxter	40	—
Benton	6	10
Black Hawk	1 00	1 20
Casco Gold	—	—
Central Gold	10	12
Cons Gregory	40	60
Grass Valley	8	14
Gunnell	100	150
Holman	5	6
La Crosse	60	66
Liberty	3	4
Montana	2	—
Rocky Mount	5	13
Quartz Hill	40	45
Smith & Parm	60	70
Sexax	—	—
New York	—	—

Petroleum.

Petroleum remains dull and unchanged—the Board quotes follows:

	BID.	ASKED.
Bennehoff Run	20	30
Bergen Coal and Oil	—	40
Blood Farm	5	—
Bliven Oil	—	50
Breevoort	1 50	3 00
Buchanan Farm	40	45
Central	50	65
Home	1 35	1 40
New York & Allegheny	1 25	—
Northern Light	30	—
Phillips Pet	5	15
Pithole Creek	—	1 00
Rathbone Oil	20	—
Rynd Farm	25	30
Second National	—	40
United Petroleum Farms	25	30
United States	35	55
Clinton	—	—
National	—	—
Sherman & B	—	—
Tarr Farm	—	—
Webster	—	—

MISCELLANEOUS.

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DEPARTMENT OF POPULAR SCIENCE.

THE OXY-HYDRIC LIGHT.

AT one of the last meetings of the New York Liberal Club (which, by-the-by, has for its president the nominee for president of the Cincinnati Convention), a lecture was given by Dr. OTT on the new Oxygen-Light. After having related the history of this discovery, the speaker proceeded to explain what oxygen is, and what are the different processes of its manufacture. Two substances, one a mineral, the other a product of the arts—peroxide of manganese and chlorate of potash—have ordinarily been the source of manufactured oxygen. This gas can be evolved from them with ease; but the processes for producing it are by far too costly for use in the industrial arts. It may, said the speaker, seem strange at first sight that a cheap and practical method for the separation of oxygen gas from the atmosphere should not have been discovered long ago. Yet, it was only a few years since that this problem may be said to have been solved. This discovery, which was first brought out at the Exhibition at Paris in 1867, is due to Mr. TESSIÉ DU MOTHAY. After having described his plan, Dr. OTT exhibited the oxy-hydric light, and explained the construction of the different burners used for its consumption. He said:

"Formerly the new oxyhydrogen light was produced in a manner similar to that of the calcium light, by bringing cones or cylinders of zirconia (whence the name zirconia light) into a glow, by the combustion of oxygen and ordinary gas. These cylinders are now dispensed with, the gases being consumed in burners terminating in two concentric pipes. The inner one serves for the conduction of oxygen, while the outer pipe is used either for street gas or hydrogen, previously carburetted. A small distance below the openings there is a perforated disk, vertically placed, and acting on the principle of DAVY'S wire gauze, so that the gases may be ignited with perfect safety.

The light thus obtained consists, not of one brilliant point, as formerly, but of a flame; and the disadvantage of having occasionally to change the zirconia crayon, indispensable in the system of illumination described, is entirely obviated. The two only objections which might have been made against the light are thus completely removed, without sacrifice to its beauty, intensity or economy.

The flame is of a beautiful, but slightly bluish white, and presents much analogy with that obtained from the stars. Being in composition more similar to the sunlight than any other artificial light, it permits us to distinguish all, even the most delicate colors, which will be a great boon to persons engaged in the sale and manufacture of colored goods.

An American gentleman, who witnessed the new system of illumination in Paris, writes:

"You would feel proud to see the *Place de l'Opera* lighted up with the oxyhydric gas. Two of the large groups of lamps are lighted with the new light, the other two with the old one. The difference is really immense. The old ones look like tallow candles in a thick fog. In fact, the new light spoils the appearance of all the shops in the vicinity; crowds are gathered around it all the time. It is strange that it is not yet better known in the United States. The light is simply glorious."

It has been alleged that, in case of fire, the danger would be greatly augmented by the escaping of the oxygen from the pipes; but when it is considered that the quantity of pure oxygen which might thus mingle with the atmosphere, is quite insignificant when compared with the vast quantity contained in the atmosphere itself, it must be admitted that this objection is entirely unfounded. If, under ordinary circumstances, the oxygen should escape into a room, its first effect would only be to increase the respirability of the air.

The speaker answered another objection made against the new light. It was stated that it is not as gratifying to the eye as ordinary gas-light. To argue this objection, he said, would be of little use, and he would only remark that all those who have witnessed it pronounce it not only as soft and agreeable, but considerably more so, than the best gas-light. "Far from fatiguing the optic nerve, it only creates an agreeable surprise, when seen for the first time."

The properties of the oxyhydric light will render it particularly useful for the lighting of streets, squares, parks, railway depots, tunnels, workshops, sales-rooms, churches, lecture-rooms, theatres, and other spacious rooms. It is destined to replace the expensive and troublesome electric light on light-houses, for military operations and the carrying on of great works at night. Again, it might be applied with advantage for sub-marine works, and it will undoubtedly render great service in the working of mines. Finally, being rich in chemical rays, this light will permit the photographer to take pictures at night.

Dr. OTT finally gave a review of the medical and industrial uses of oxygen, and closed with the following extract from the ENGINEERING AND MINING JOURNAL of Sept. 20th, 1870:

"There need be no doubt entertained with regard to the applicability of this gas to useful purposes if once it could be cheaply produced on a practical scale. The different purposes for which combustion is required in all branches of manufacture would find a new field opened up for them; our power for producing heat would be increased, and with it all our facilities for producing mechanical or chemical effects would be vastly improved and multiplied."

The real novelty and importance of the new light, as it is somewhat inaccurately called, lie in the new process for the cheap manufacture of oxygen, in which the oxygen of the atmosphere is utilized. This process, concerning which so much has been said pro and con, is in actual operation in this city; and though the product is not chemically pure, it seems to be sufficiently so for most purposes, and particularly for the production of light, in combination with hydro-carbons. It is said that several leading theatres are about to adopt this light, and that large works on the East side are erecting for the manufacture of the gas.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. It is believed that several names of members and associates elected at the Bethlehem meeting in August, 1871, have been accidentally omitted by reason of the loss of a portion of the records of that meeting. Such persons, or their friends, are requested to communicate with the Secretary.

II. All members and associates who have not paid their dues are requested to do so at once, by sending in postal orders, or checks, or money, ten dollars to the Secretary.

All members and associates who pay their dues for each current year, strictly in advance, will have sent to their address, regularly and weekly, the ENGINEERING AND MINING JOURNAL, which is the organ of the Institute, and will contain the proceedings and transactions, and all important papers read before the Institute, and all notices of meetings. Back numbers cannot, as a general rule, be sent.

III. It is expected that the more important papers read before the Institute, and the debates thereon, will be published in annual or semi-annual volumes to which those members and associates will be entitled who have paid their dues.

IV. Authors of papers are requested to notify the Secretary in advance of the meetings, giving the subject and length of their papers. Attention is also called, in this connection, to Rules 12 and 13.

The annual meeting of the Institute will be held in the city of New York, commencing on Tuesday evening, May 21st, at 8 o'clock, in the Cooper Union Building, at the head of the Bowery.

A meeting of the Council will be held at the office of the ENGINEERING AND MINING JOURNAL on Tuesday afternoon, May 21, at three o'clock. Members of the Council will take notice that the office of the JOURNAL has been removed to 27 Park Place, corner of Church street.

Table of Atomic Weights,*

Compiled according to the Latest Determinations, for the Use of the Students of the School of Mines, Columbia College, Jan., 1872.

BY C. F. CHANDLER, PH. D.

Hydrogen,=1.

		OLD.	NEW.
Oxygen,	O.	8·	16·
Aluminum,	Al.	13·7	27·4
Antimony,	*Sb.*	122·	122·
Arsenic,	*As.*	75·	75·
Barium,	Ba.	68·5	137·
Bismuth	*Bi.*	210·	210·
Boron,	*B.*	11·	11·
Bromine,	*Br.*	80.	80.
Cadmium,	Cd.	56.	112.
Cæsium,	*Cs.*	133·	133·
Calcium,	Ca.	20·	40·
Carbon,	C.	6·	12·
Cerium,	Ce.	45·7	91·3
Chlorine,	*Cl.*	35·5	35·5
Chromium,	Cr.	26·1	52·2
Cobalt,	Co.	30·	60·
Columbium,	*Cb.*	94·	94·
Copper,	Cu.	31·7	63·4
Didymium,	D.	47·5	95·
Erbium,	E.	56·3	112·6
Fluorine,	*F.*	19·	19·
Glucinum,	Gl.	4·6	9·2
Gold	*Au.*	197·	197.
Hydrogen,	*H.*	1·	1.
Indium,	In.	56·7	113·4
Iodine,	*I.*	127·	127·
Iridium,	Ir.	99·	198·
Iron,	Fe.	28·	56·
Lanthanum,	La.	46·	92·
Lead,	Pb.	103·5	207·
Lithium,	*Li.*	7·	7·
Magnesium,	Mg.	12·	24·
Manganese,	Mn.	27·5	55·
Mercury,	Hg.	100·	200·
Molybdenum,	Mo.	48·	96·
Nickel,	Ni.	29·	58·
Nitrogen,	*N.*	14·	14·
Osmium,	Os.	100·	200·
Oxygen,	O.	8·	16·
Palladium,	Pd.	53·	106·
Phosphorus,	*P.*	31·	31·
Platinum,	Pt.	98·7	197·4
Potassium,	*K.*	39·1	39·1
Rhodium,	Ro.	52·	104·
Rubidium,	*Rb.*	85·4	85·4
Ruthenium,	Ru.	52·	104·
Selenium,	Se.	39·5	79·
Silicon,	Si.	14·	28·
Silver,	*Ag.*	108·	108·
Sodium.	*Na.*	23·	23·
Strontium,	Sr.	44·	88·
Sulphur,	S.	16·	32·
Tantalum,	*Ta.*	182·	182·
Tellurium,	Te.	64.	128·
Terbium,	Tb.	37·7	75·4
Thallium.	*Tl.*	204·	204·
Thorium,	Th.	59·2	118·4
Tin,	Sn.	59·	118·
Titanium,	Ti.	25·	50·
Tungsten,	W.	92·	184·
Uranium,	U.	60·	120·
Vanadium,	*V.*	51·3	51·3
Yttrium,	Y.	30·8	61·6
Zinc,	Zn.	32·5	65·
Zirconium,	Zr.	44·8	89·6

* The Perissads are printed in italics, the Artiads in Roman. To convert formulæ in the old system into the new, double the atoms of the Perissads, or halve the atoms of the Artiads, and *vice versa*.—*Am. Chemist.*

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D., Editor.

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Our Iron Industry.

THE present high price of iron, though it has been attained somewhat suddenly, was not unforeseen, and seems likely to last for a considerable period. It is quite independent of the tariff, and results from the enormous demand for iron throughout the civilized world, and the failure of the supply to keep pace with the rapidly-growing consumption. This state of things has been predicted for a year or two past by those best acquainted with the condition of affairs in England and upon the Continent. It is evident that the conditions of ore and fuel in foreign countries are not such as to permit even a sufficiently rapid, still less a sufficiently permanent, expansion of the production of iron. In fact, no country but the United States is able to meet the demands of the new era upon which the commercial world is entering. The extraordinary activity and progress manifested in our iron trade is based on this sure foundation; and the day is evidently nearer than has been supposed, when our great natural advantages (so clearly set forth in the Paris Exposition report of Mr. ABRAM S. HEWITT) will give us not only the control of our own markets, but a commanding position in the markets of the world.

The Danks Furnace.

No doubt is entertained, after the careful and thoroughly favorable report of the English Commissioners sent to this country, that the mechanical puddling furnace of Mr. DANKS is a perfectly successful and highly important invention. The opinion expressed in our columns by our special travelling correspondent, Dr. STAPFF, a couple of years ago, is completely confirmed by practice. The Iron and Steel Institute of Great Britain approached the examination of this question in a manner highly praiseworthy for its caution and deliberation, as well as its spirit of manly fairness towards the American patentee. During all the debates and investigations of that body, no doubt was thrown upon the validity of his claims, or the essential novelty of his invention. The fact is unquestioned, that no attempts at mechanical puddling had given satisfactory results, until Mr. DANKS had worked out the whole problem and made it a commercial success.

In this spirit the preliminary negotiations with English ironmasters went forward. The trade intimated that the royalty first demanded by him, of 2s. per ton, was too high; and a compromise was arranged by which Mr. DANKS undertook, on certain conditions, to allow subscribers to the arrangement to erect a first lot of 200 furnaces, for a sum of £50,000, to be paid within six months, and to allow the same parties to put up any further number of furnaces on the same terms—£250 per furnace, or a royalty of sixpence per ton. This agreement was to be ratified on April 10th. On the 5th of April, however, at a meeting of the trade, it was announced that the committee appointed to carry it into effect had taken legal opinion as to the validity of the DANKS patents, and had been advised that they were invalid. The opinion, which we shall not quote, is given in substance by the *Iron and Coal Trades Review.* It amounts to this, that the chief points of these patents have been anticipated singly, by patents of 1860 and 1863, while Mr. DANKS's claims go no further back in England than 1869 and 1870. It is not pretended that these earlier patents were put into successful practice. Some of them, if not all, were allowed to lapse. The opinion, which is supported by high authority, leaves nothing to Mr. DANKS but a doubtful claim to the use of certain fixed proportions of alkali and silica in the fettling, and a late patent for certain improvements in the apparatus, which may or may not be essential. Whatever may be its legal force, it is calculated to work great injustice to the American inventor, whose industry, perseverence and genius have certainly entitled him to a reward of which he may now be deprived upon technical grounds.

This feeling, we are glad to notice, was clearly expressed at the meeting above mentioned. Mr. MENELAUS, the chairman, was one of the commissioners who examined the furnace in this country, and reported heartily in its favor. He evidently felt it to be a painful duty to announce the adverse result of the legal inquiry. The committee also reported that, whatever his legal position might turn out to be, Mr. DANKS was justly entitled to a handsome pecuniary acknowledgment from the iron trade, on account of the value of his work in demonstrating the practicability of mechanical puddling. The latter gentleman on his part refuses to accept any such arrangement, and announces his readiness to defend his patents before a legal tribunal. If such should be the issue of the controversy, both parties would expend a great deal of money to no good purpose. We sincerely trust that this result may be avoided. The £50,000 arrangement appears to be definitely abandoned; but several individual firms are about to make private arrangements with Mr. DANKS; and in this way he may succeed in building up a party in his favor among the ironmasters, and so avoiding a contest with the tremendous power of the united trade.

This affair illustrates one of the incidental evils of the patent law as at present administered. Innumerable abortive inventions are so protected by far-reaching claims and specifications as to be really hindrances to real improvements. One man's failure erects a barrier for half a generation against another's success. Those inventors who rush to the Patent Office with their crude guesses, visionary schemes and mechanical inspirations, get an unwarrantable claim upon the patient and thorough workers who, proceeding step by step, and elaborating their plans to final success, find that they have embodied the random thoughts of some "genius," who did not know what he was inventing, nor how to make it practically useful. There is one comfort: technicalities can be pleaded on one side as well as the other; and in the case of Mr. DANKS, we trust that if it comes to a legal conflict, there will be (as there were in the celebrated MORSE telegraph suits) technical grounds sufficient to justify the commercial protection of the man who, as all acknowledge, has solved for the first time the practical problems involved.

The following extract from *Engineering*, received since the foregoing was written, indicates a new phase in this controversy:

"Mr. DANKS, who has, since a section of the ironmasters took exception to his patent rights, consulted Mr. THOMAS HUGHES, M.P., Barrister, and acting upon that gentleman's advice, he has obtained a supplementary patent for his furnace. The Welshmen who have raised such a strong objection to paying Mr. DANKS any royalty may now find that they have been in too great a hurry in their attempted sharp practice. Should any of those gentlemen desire to make terms with Mr. DANKS, they may find that he will recollect the way in which they tried to deprive him of his rights, and will make them pay smartly for using his puddling furnace. We hear that several puddling furnaces similar to Mr. DANKS's are being brought under the notice of the American ironmasters. Whether practically they are equal to Mr. DANKS's remains to be seen. Up to the present time we have not heard of any objection on the part of the workmen in England to the introduction of DANKS's furnace. This is contrary to the expectation of a large number of persons. It is very satisfactory, and shows that the ironworkers have more common sense than they were credited with.

Atoms and Molecules.

BY SAMUEL D. TILLMAN, L.L.D.

[Continued from page 292.]

ON examining the numerous works on chemistry, published within the last twenty years, one cannot fail to notice a gradual change in the expressions employed in describing reactions. The word "equivalent" seems to have lost the meaning originally assigned to it by Wollaston, and the terms "combining weight" and "combining proportion" are now used less frequently than "atomic weight" and "atom." This abandonment of old forms of expression doubtless indicates a gradual change of opinion among leading chemists, a change which may be ascribed partly to an accumulation of facts tending to confirm the atomic theory, and, partly, to the promptings of that mysterious intuition which, overleaping the limits of logic, often arrives at correct conclusions even before their truth has been demonstrated.

During all the discussions on "atomicity" hardly a doubt has been raised as to the actual existence of the atom. It was not, therefore, surprising, that the chemical world received a sensible shock at the stand made by BRODIE in 1868.* However, a careful examination of his paper is likely to lead to the

* The Calculus of Chemical Operations. By Professor B. C. BRODIE. *Journal of the Chemical Society.* London. Vol. XXI., p. 367.

conclusion that the objections to the atomic theory therein enumerated, are not more formidable than those which can be urged against his own ingenious but complicated method of chemical operations. Precision in signs and definitions leads to exact results in the abstract, nevertheless a mathematical formula often requires modification to meet the varying conditions found in actual practice, and even then it only gives a near approximation to the truth.

Renewed attention to this subject, was doubtless the means of drawing from the then President of the London Chemical Society a paper "on the Atomic Theory" which is generally regarded as the best exposition and defence of the doctrine yet made, and which may be consulted with profit by those desiring to obtain a clear statement of the principal results of chemical research adduced for its confirmation.*

A vigorous attack on the atomic theory has since been made by MILLS, the real tendency of which is to raise doubts concerning the existence of matter itself.† He quotes with evident satisfaction from a work by DIGBY "on the nature of bodies" printed in 1645, wherein *quantity* is defined "as but one *whole* that may indeed be cut into so many several parts; but those parts are really not there till by division they are parcelled out; and then the whole (out of which they are made) ceaseth to be any longer, and the parts succeed in lieu of it, and are every one of them a new whole." From this statement proceeds a train of geometrical reasoning concerning extension and division which leads to the old dilemma regarding finite and infinite indivisibles.

Fortunately a new science, unknown to DIGBY, has demonstrated that matter has other than mere physical properties which are so clear and well defined as to enable its votaries to determine the ultimate composition of all bodies. The Chemist affirms that, however inclined we may be to regard a body as a whole, it is in fact composed of minute parts which may be separated, and that in the great majority of bodies, which are compounds, nature has herself made divisions by incorporating unlike parts which may be replaced by other unlike parts. On questions relating to the actual size of these parts, their form, their structure, etc., he makes no issue; he simply asserts that all these ultimate parts are permanent, and that those composed of the same kind of matter are identical in size and structure. The limits proposed for this paper will permit elucidation of this point alone.

The clearest conception of molecules and atoms will be arrived at by examining the principal phenomena attending the mechanical mixture and final chemical union, of the lightest and the heaviest of the simple gases. The electro-positive element, Hydrogen, is a permanently elastic gas, having a relative density expressed by I. Its properties are in marked contrast with those of Chlorine, a yellowish green gas, which may be condensed into a liquid, by a pressure of about four atmospheres. The density of this strong electro-negative element is 35·5. If two vessels of equal capacity, filled with these gases respectively, be placed in the dark, one over the other, and a communication be opened between them, a mutual diffusion of the gases will commence, the relative velocity being inversely as the square root of their densities. The action continues untraversed by the force of gravitation until minute portions of hydrogen and chlorine are equally diffused throughout both receptacles. This phenomenon cannot be accounted for, excepting on the supposition that minute parts of each gas have undergone complete isolation. If diffusion were effected only through a single stratum or extremely thin layer it would be possible for two gaseous elements to retain their continuity by passing each other in intertwining streams, thus forming like threads, a warp and woof: but when diffusion is in every direction it is obvious that these elements must positively separate each other, and thus be divided into extremely diminutive bodies each of the same dimensions. Let *l* represent the lighter gas, *d* the denser, and *e* the dimensions or size of each isolated portion, then *el* and *ed* will denote the dissimilar parts of which the whole gaseous mass is composed. As the phenomenon of diffusion occurs under the conditions mentioned, whatever may be the quantity of gases employed, it follows that *el* and *ed* are individual volumes or molecules, invariably of the same dimensions. This diffusion of gases may therefore be defined as the uniform intermingling of dissimilar molecules.

If the molecules *el* and *ed* thus commingled while in the dark, be exposed to direct sunlight an instantaneous and complete chemical combination occurs with explosive violence but without condensation; or if exposed to diffused daylight the union of elements will be gradual and without explosion; the resulting compound in each case being hydrochloric acid gas.

The affinity or force of chemism is generated by the action of light on the colored gas Chlorine, which, by absorbing all the rays and transmitting only the yellowish green, acquires a power which seems to be expended by the union of that element with Hydrogen. Early in the present century, M. BENARD announced that the new properties acquired by Chlorine on exposure to light, were derived from the violet ray. In 1843 DRAPER proved by experiment the relative power of each ray in producing this change, the actinic rays being altogether the most effective.* Mr. E. BUDDE has recently described a remarkable experiment in this direction. He found that a differential thermometer filled with Chlorine, expanded about seven times more in the violet than in the red ray of the solar spectrum; when the same thermometer was filled with CO_2 no action was noticed.†

As the combination of Hydrogen and Chlorine is effected without change of volume, it is obvious that the molecule *el* does not unite with the molecule *ed* forming a compound molecule *el ed*. The conclusion is therefore unavoidable that each molecule has been divided into two equal parts, and that by affinity, like parts have been separated, and unlike parts united. These parts are the smallest quantities, that can be isolated and are in fact the atoms recognized by the Chemist. If this smallest combining proportion or atom be designated by *a*, the actual composition of the Hydrogen molecule *el*, weighing 2, may be clearly represented by *al-al* (weight 1 + 1) and the Chlorine molecule *ed* weighing 72, by *ad-ad* (weight 35·5 + 35·5). As the attraction of *al* to *al* and of *ad* to *ad* is, after exposure to light, less that of *al* to *ad*, there is an instantaneous chemical change by which one molecule of hydrogen and one molecule of chlorine, are transformed into two molecules of hydrochloric acid gas. This reaction is clearly indicated by the following equation: *al-al*+*ad-ad*= *alad*+*alad*=2*alad*.

The symbols here used are intended to convey to the mind an idea of the relative size of combining parts, which is not so apparent when expressed as follows:

$$H_2 + Cl_2 = HCl + HCl = 2HCl.$$

From the simplest of molecular types, we might proceed to the most complex; and, throughout, if we consider the combining proportion of each simple constituent as either a unit or a multiple of a unit the composition of each molecule may be expressed by whole numbers. Thus having as many different kinds of units as there are elements, any true chemical combination may be symbolized by a combination of arithmetical ratios. This method, under the light of the atomic theory, clearly reveals the harmonic relations of molecular constituents, which seen from the stand-point of percentage composition appear unconnected and discordant.

It must be admitted that many of the reactions of well-known bodies have not yet been determined quantitatively, yet were they made out, we should not be able to demonstrate by experiment the truth of the Atomic doctrine. It still remains a theory in favor of which there are many facts and phenomena that, collectively, form an argument not easily to be outweighed. This evidence may be briefly summarized as follows:

1. *Atomic Weights.* Elements combine in extremely minute parts, according to the law of definite and multiple proportions. The atomic weight of an element is either its equivalent weight, or a multiple of it; as such multiple cannot be divided by reaction, its weight must conform with the atomic number. Whatever changes of position the combining weight of an element may undergo in a series of molecular metamorphoses, that is to say, however many times it may be displaced and replaced in chemical combinations, it invariably retains one of its characteristics, weight. This invariability of weight is an essential property of the atom

2. *Atomic Volume.* Gases unite in equal volumes or multiple volumes. If hydrogen be taken as unity the density of each elementary gas is identicalwith the weight of its atom. The atomic volume, determined by dividing the atomic weight of a body by its specific gravity, has been the means of revealing many interesting relations among compounds of similar structure, and among many containing different components and of unlike structure.

3. *Atomic Heat.* It has been shown by expriment that quantities of each element conforming with its atomic number have the same capacity for heat, excepting only carbon, boron and silicon; these, it is believed, will yet be found to conform to the law, that the specific heats of all atoms are the same. This law is regarded as a direct confirmation of atomic weights.

4. *Molecules.* According to the atomic theory chemical forces are brought in equilibrium when atoms combine and form a molecule. Every gas and every vapor undecomposed has a density proportional to its molecular weight. All known molecular combinations and combining proprtions are in accordance with the atomic doctrin. Decomposition by electrolysis affords some evdence that the constituent parts of a molecule which are simultaneously separated, are proportionate to atomic weights.

5. *Atomic combining capacity.* The modern doctrine of types and substitutions, is soley based on the individuality of the atom, without which the whole fabric of typical structures must fall.

6. *Isomerism.* The fact that bodies containing the same elements, and in precisely the same proportions, exhibit different properties, has been thus far accounted for only on the supposition that atoms are differently arranged in each body. These differences in arrangement depend not only on the relative position of atoms, but also on the order, as to time, in which they combine; for two or more atoms having such precedence over others as to combine first, may, by that means, form a radical of such permanence as to play the part of an atom. Aside from the question of radicals, we may ascertain the number of different bodies which can be formed from the same number of different atoms, by an application of the mathematical law of pemutations,

7. *Homogeneity.* The uniformity of structre and appearance of any element or chemical combination of elements, furnishes the most palpable proof of the identity in size and shape of those definite parts which we designate as molecules. This homogeneity is retained under different degrees of pressure, thus making it apparent that molecules are not nly iden-

* On the Atomic Theory. By Prof. A. W. WILLIAMSON. *Jour. Chem. Soc.* London. Vol. XXII., p. 328.

† On the Atomic Theory. By EDMUND J. MILLS, D. Sc *Philosophical Magazine.* Vol. 42. No. 278. p. 112.

* A Treatise on the Forces which produce the Organization of plants. By JOHN WILLIAM DRAPER, New York. HARPER & BROTHERS. 1843.

† *Pogg. Annalen* for 1871 No. 10.

tical in structure but that they approach and recede in precisely the same manner under the same conditions.

Finally.—The foregoing statements regarding the existence of atoms which are indevisible and indestructible, under the present order of things, does not preclude the supposition that the atom may be a cluster of smaller particles held together by a powerful affinity, which, when counteracted, would leave them free to move within a given sphere. On this assumption it is highly probable that the relative position of such particles may modify the combining capacity of the atom. Moreover, the normal motion of such particles may determine not only the peculiarities of elemental spectra, but produce other effects not dependent on the amplitude of atomic oscillations, thus favoring the inference that the atom itself is a receptacle of force.

About-Town Jottings.

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DR. GRAGER dissolves the alloy of silver in nitric acid, taking care to use as small a quantity as possible; the solution is then transferred to a large-sized porcelain basin, and gradually neutralised with previously-lixiviated chalk free from chlorine. The neutralised liquid is next boiled, and chalk again added to it, while boiling, until the fluid has become colorless (in order to test more accurately, a drop of the liquid is poured on a piece of white filtering paper, and next to that drop is placed one of a solution of ferrocyanide of potassium; as long as the well known red coloration, copper reaction, hereby ensues, chalk is added). The fluid is next filtered, to separate the carbonate of copper, and the filtrate (a solution of nitrate of silver and nitrate of lime) is again boiled, and either further treated with carbonate of lime or, better still, with carbonate of soda; the bright yellow colored precipitate thereby ensuing, a mixture of carbonate of silver and carbonate of lime, is washed, dried, and ignited, leaving a greyish white mass of metallic silver mixed with carbonate of lime; this mixture is treated with dilute hydrochloric acid, washed with distilled water, and then fused along with borax, yielding pure silver. The bright green-colored carbonate of copper can be used as a pigment for painting purposes.

MINING SUMMARY.

Nevada.

From the Mining Review of the Reese River *Reveille* of April 20 and 27.

REESE RIVER.

Pacific Co. (Limited).—From Captain Prideaux, Superintendent, we glean the following: In the Lane & Fuller shaft a cross cut is being run at the 550 foot level, and a small quantity of high grade ore extracted from the ledge. From the 400 foot level a large quantity of high grade ore is being extracted, the 1st class working $809 per ton, 2d class $206. At this level the pay streak is extensive, varying in width from six inches to two feet in the two ledges now being worked. The 300 foot level is under lease to parties who are getting out good ore from a pay streak of an average width of six inches. Owing to the breakage of the gallows frame, there was a delay of three days this week, but at present the work is moving along smoothly. In the Buel North Star at the 500 foot level, the ledge is stripped longitudinally for a distance of 200 feet, showing a face of ore the entire length, estimated to average $100 per ton, the width of the ledge averaging from one to three feet. Working in all fifty-four men.

Grove Tunnel.—This mine is let out in contracts to various parties. Moore & Co. are running a level from the 200 foot level and are getting good ore which is being hoisted and piled in the ore house. Reynolds & Co. are running a level, and getting no ore at present. Canterbury & Co., are now in the break, and have had no ore in the last 30 feet, but have indications of striking pay grit soon. Delano & Co. are working from the main tunnel, have run drifts each way from the incline at east end of tunnel, now breasting in good ore. About 12 tons high grade rock on dump. Moore & Co., hoisting good ore and piling in ore house. Now in ore house about 40 tons high grade ore belonging to various lessees. Total number of men working, 22. Lamb & Co., drifting both ways from incline, breasting in good ore on west side.

Morgan & Muncey.—At bottom of 400 foot level, the ledge is of an average size of 12 inches, all ore estimated to average $400 per ton without sorting. In eastern part of same level the ledge is of an average width of 2 feet, with a streak of 4 inches of high grade ore, and the ballance low grade, with no waste. Hoisting good ore and piling in ore house. Now in ore house 35 tons high grade; will shortly commence shipping to mill. Working 5 men, but intend to increase force shortly.

Semantha.—There has been great improvement in this ledge since our last. The ledge having widened considerably and the grade of the ore being much enhanced. Working 8 men.

Manhattan Shaft.—There are over 100 tons of good ore on the dump at this mine belonging to the contractors. Hoisting ore from the lower levels. Working 35 men.

Florida.—The Sub-lessees are getting out ore of a very high grade of which there is about 12 tons on the dump. Shipping to the Manhattan. Working 12 men.

Star of Nevada.—This mine is owned by an English incorporation. There is a tunnel in to the depth of 500 feet, in the east level, At this depth there is a ledge from 12 to 14 inches in thickness. At a distance of 75 feet in the main tunnel Kelley & Co. are working in a level, on a lease, and are extracting some splendid ore which they are sorting for shipment and will commence shipping next week. Working 12 men. At some future time we will give a lengthened account of this mine, which promises to become one of the leading mines on Lander Hill.

YANKEE BLADE.

Ensign.—Working in incline at depth of 50 ft., average width of ledge 6 inches, which is all pay. During the week past 16 tons, of an estimated value of $150 per ton, has been shipped to Manhattan mill, and 1½ tons which assayed $1,000 per ton. Working 3 men.

Kling & Kelly.—Shaft now down 150 feet. Average width of ledge 2 feet. Shipping ore to Manhattan, varying by assay from $100 to $350 per ton. Working 30 men.

Virginia.—Four tons of ore from this mine worked at the Manhattan, gave a return of $887 per ton, and there is still a good body visible in the mine; working six men.

BELMONT AND VICINITY.

The owners of the Monitor Mine at Belmont have just shipped between thirty and forty tons of ore to the mill in Mammoth District, and have 30 tons on the dump which will work $400 per ton. Scarcity of teams will not enable them to ship their ore as fast as it is taken out. The mine was never looking better or showing a finer body of ore than at present.

The Combination Company's Highbridge mine is leased to John Sharp and N. A. Gavin, who are working fifteen men and taking out considerable quantities of $300 ore at a depth of 145 feet.

Jefferson Canyon ten miles west of Belmont is attracting considerable attention and present appearances indicate that during the ensuing season a large amount of high grade ore will be shipped from that district. The snow is just getting off the mountains, consequently but little work has yet been done this season, there being at the present time only about fifteen men at work in the Canyon. The ledges are narrow but rich, varying from eighteen inches to three feet in width; about twenty-five tons of ore on the different dumps will work from $500 to $800 per ton. The country rock is porphyry and granite; none of the mines in the district have been extensively worked but what developments have been made, indicate that the ledges are continuous and permanent: a shaft 56 feet in depth on the extension of the Rappahanock shows a well defined ledge all the way with a fine body of ore at the bottom. The principal claims which at present show good bodies of ore are the Prussian, Prussian South, Sailor Boy, Rappahanock, Jefferson, Summit and Sunset, all of which have been developed to a greater or less extent, and give promise of becoming productive and paying mines. Developments will doubtless be made here during the ensuing season which will place the district in a prominent position among the mining localities of Eastern Nevada.

OPHIR CANYON.

Murphy Mine.—This mine, situated at Ophir Canyon, has for several years past until within the last few months been lying idle, the old company having gone into bankruptcy, which state of affairs was brought about by the bad judgement and mismanagement of the persons in charge, rather than from lack of intrinsic worth of the property, although at the time operations were suspended, the Murphy was reported to be a worked-out mine.

The property, however, has since fallen into the hands of a San Francisco company and in the early part of winter Mr. P. S. Buckminster took charge of it as Superintendent, since which time bodies of ore have been struck and other developments made which indicate that the ledge is by no means exhausted, but that it bids fair to become a productive mine and a valuable property. Since the 15th of February about 300 tons of ore have been taken from the mine which averaged $125 per ton. The ledge is 20 feet in thickness in which are two veins of pay ore, one five feet and the other from six inches to two feet in width. The incline is down 270 feet with a fair showing of pay ore at the bottom although the rock now being taken out is from drifts from 120 to 240 feet from the surface. When operations were re-resumed last winter there was no pay ore at the bottom of the incline but it came in upon sinking four or five feet and steadily increased for a distance of twenty feet which is as far as it has been sunk up to the present time.

The most favorable indication of the continuity of the silver bearing veins is the fact that no matter how much or often they contract or "peter out" they can be followed by the streak and when the ore comes in again it is invariably of the same character and class, viz: sulphuret blended with native silver.

GOLD MOUNTAIN AND LIDA VALLEY.

There are at present at Gold Mountain about thirty men and at Lida Valley about twenty, who are engaged in prospecting the ledges already discovered. In a tunnel run by B. F. HIGGS, at Gold Mountain, water sufficient for domestic purposes has been struck. At Mount Magruder, 17 miles distant, is a sufficiency of water for quartz mills. The formation at Gold Mountain is sienitic granite and porphry, and the ore is in the form of sulphurets and chlorides of silver, and sulphuret and free gold. About 7 miles from Gold Mountain are several ledges carrying carbonate ores suitable for smelting. The principal mines at present are the Borneo, Shaw and Nova Zembla on which shafts have been sunk from 10 to 15 feet in depth, showing well defined ledges and good ore, numerous tests of which give an average of over 200 dollars per ton. Picked rock worked in an arastra to the amount of 100 lbs per day gives a yield of $10 per day to the man. Mr. HISKEY, who is superintending mines for a San Francisco company is shipping ore to a small mill at Deep Springs but contemplates shortly erecting a mill on a large scale. At Lida Valley both water and wood are plenty, and all who have visited the section, speak in glowing terms of its mines and prospects.

WHITE PINE.

From the San Francisco *Herald and Market Review* of April 26th.

It affords us pleasure to be able to announce a decided improvement in the affairs of this district. The clouds that but a little while ago lowered so darkly over the English companies there have lifted somewhat, and there is little doubt but matters are working into a better condition with both of them. How little ground there is for complaint in regard to the situation and prospects, or yet the management, of the Eberhardt and Aurora Company, may be inferred from the fact that Prof. CLAYTON,

in reply to an inquiry from the Directors, has lately expressed a highly favorable opinion on each of these points. That this opinion would be accepted as conclusive here, where Prof. CLAYTON is so well known, it is useless to add. Both the mill and the tramway of this company—the latter for a time a source of much vexatious delay—are working satisfactorily now. The scarcity of water, also, for a season severely felt, has been obviated, and its recurrence guarded against by the purchase of the White Pine Water Works, a property valuable in itself, and essential to the future success of the company. Exploitation continues to develop good bodies of ore in the several claims of the company, whether pushed in a vertical or lateral direction; and it seems hardly possible that any new impediment should arise to defeat or much longer postpone the success that this company was justly led to count upon from the first.

In regard to the mines of the South Aurora Company, it can only be said that having exhausted the more productive ore bodies in their upper works, they are driving a funnel on a lower level, in the hope of reaching others at a greater depth. This work is being conducted with economy and judgment, and should it finally fail of the end proposed, the company will have secured, through the acquisition of the Chloride Flat Claims, adjoining their original grounds, a considerable extent of rich but somewhat irregular deposits, which will no doubt afford material upon which to run their mill for a long time with profit. These claims were conveyed to the company by the vendors of the South Aurora Mine gratuitously and in consideration of that property having failed to prove as valuable as had been by all parties expected. In addition to this very liberal gift, these vendors had before donated the company, and for the same reason, the princely sum of $250,000, fifty thousand of which has already been paid over, and the balance secured to be paid, the whole to be used, if required, in the future exploration of their mine. This generous and noble act on the part of the vendors—Messrs. Seligman, Stanford and Sharp—has greatly exalted them in the estimation of both the buyers and the general public, and tended to allay a certain amount of ill-feeling engendered by what was considered a species of sharp dealing practiced in connection with the sale of some other of these White Pine properties in London. In the meantime the mill of the South Aurora Company has been kept running on ores gathered from various sources, and being a first-class establishment, centrally and favorably located, there is little doubt but it can, in any event, be kept constantly and profitably employed. Should all the sources of ore supply now owned by the company eventually fail, there are other good mines in the vicinity that can at any time be cheaply purchased, or their mill could be run to advantage on custom ores.

Apart from the properties of these English companies, the mines generally in the White Pine District are looking moderately well, and it is believed that the current year will show a large increase of bullion over the past. The product last year reached a little over two millions, an amount that we have good reason to believe will be doubled this year, as every mill in the district, capable of doing good work, will hereafter be kept steadily employed on fair-grade ore.

Some additions will also be made to the milling capacities of the district this spring, a powerful San Francisco company having already commenced refitting and enlarging the Pioneer Mill of White Pine, the first ever erected there, and now in a dilapidated condition. This establishment was brought over from the Hot Creek country, late in the fall of 1868, and reconstructed at Hamilton—this being but a few months after the discovery of the White Pine mines. The feat was a difficult one, there being then no roads to facilitate its removal, nor yet any lumber or other material to be had to aid in rebuilding it. The work was accomplished by Captain JEREMIAH MILLER, a man of irrepressible enterprise and boundless energy, who has charge of the present work, having, fortunately for all concerned, once more identified his own with the general interests of the district. This company, besides running their mill—to be in every respect first-class—will also largely engage in opening the valuable mines they own near by, and thus add materially to the bullion product and common prosperity of the district.

The Ward Beecher Consolidated ground, adjoining that of the English company, and now owned by Governor BLASDEL, is said to be looking remarkably well, there being a sufficiency of ore reserves to keep both the mills belonging to the owner profitably employed for a long time to come. The Charter Oak, the Hidden Treasure and its several extensions, the San Juan del Rio, and other early locations in White Pine, are developing into valuable mines, promising soon to put a different face on the aspect of affairs in that district. The San Juan del Rio lies in Mahogany Canon, quite apart from the group of mines that first gave *eclat* to White Pine, and by its magnitude and wealth, demonstrates that the rich ore-deposits of that locality are not confined to a single channel. The credit of engineering it up to its present importance is due to Capt. WM. BOYLE, an old and successful Washoe millman and miner. Important discoveries have also lately been reported as occuring some distance below Hamilton, quite at the opposite end of the ore-belt carrying the principal mines heretofore worked.

GOULD AND CURRY IMPROVEMENTS.

The Gould and Curry Company, says the Virginia *Enterprise* of the 4th inst., are making very extensive and important improvements at their main shaft. The old hoisting frame and all connected therewith is being taken down preparatory to the erection of new and more powerful and substantial hoisting machinery. The works were shut down day before yesterday for the purpose of making this change, and the new works are in such a state of forwardness that they will be ready to start up in about ten days from the present time. A new and most substantial fire-proof building of stone and brick, forty by eighty feet in size, is being erected over the Bonner shaft, and in this is now being set up a new and powerful hoisting engine. This engine is of the same capacity as the large new engines in use at the Crown Point and Belcher mines, and it will be used for hoisting up from the new incline about to be commenced below the 1,500 foot level. All the machinery is very heavy, the fly-wheel weighing 6,200 pounds the spur-wheel 9,600 pounds, and all else in same proportion. The opening for the commencement of the incline is completed, and now stands the largest untimbered cavity on the Comstock range, being a grand artificial cavern forty-two feet wide by sixty-five in height. But that this work is done in hard blasting-rock it would be very unsafe to make so large an opening without securing it with heavy timbers.

The bottom of the Gould and Curry shaft is now lower than any other point reached by the Comstock. The bottom of the shaft is 1,800 feet below the surface, and below this has been sunk a sump twenty-one feet deeper. At the bottom of the sump has been blasted out, to the westward, in the solid rock, a reservoir capable of holding 35,000 gallons of water. The bottom of the shaft and bottom of the sump are perfectly dry, but it was thought best to make the reservoir in order that any rush of water (from any source) could be controlled. It is not likely that they will ever be troubled with water from below, but in case of accident to the pumping machinery that above might flood the incline, in case no receptacle for it was provided at the bottom of the shaft. The new building will be covered with an iron roof, and every precaution taken to guard against fire from the row of frame buildings standing immediately to the west. An improvement worthy of note in the sheaves of the hoisting frame, over which the wire cable will run, is that they are all lined with wood. This improvement was the suggestion of Mr. Lackey, Superintendent of the mine, and is one which will doubtless be adopted in all our leading mines. The cable running over wood, instead of iron, will prevent the weakening of the strands by crystallization. Workmen swarm about the shaft and everything is in such a state of forwardness that we have no doubt of the new works being ready to start up at the time mentioned.

A NEVADA MINING SCANDAL.

ASSOCIATED PRESS DESPATCH.

San Francisc, May 8.—Intense excitement and indignation were produced here to-day by the publication of what purports to be revelations made to William Sharon and his associates by J. S. Hubbell, a guardsman in the Nevada State Prison, and formerly the underground superintendent of the Yellow Jacket Mine. Is is alleged that Hubbell made a detailed statement charging that the fire in that mine, three years ago, by which so many lives were lost, and damage to the extent of millions of dollars done, was set intentionally by G. T. Kellog, who was employed for that purpose by J. P. Jones, the Superintendent of the mine. Hubbell declares however, that he made this statement at the instance of Sharon's friends, having been promised $50,000 for doing so, for the purpose of ruining Jones, and that he refused to sign it, and himself informed Jones of the plot against him.

Jones and Hubbell recently ousted Sharon and his friends from the management of the Savage Mine, and Jones and Sharon are now bitter rivals in mining speculations, and are also rival candidates for the United States Senatorship from Nevada. Public sympathy is all on the side of Jones. The matter will go into the criminal courts immediately.

Utah.

A correspondent of the *Alta*, writing from Little Cottonwood, U. T., says: The confidence of San Francisco capitalists in the mines of this Territory is steadily increasing, and notwithstanding the Monitor and Magnet and one or two other fiascos, I know personally that San Francisco operators in the mines here have in the aggregate of their investments made a large amount of money. The proportion of their losses to profits is less than in any other mining region on the coast, and as a natural result they have commenced active mining operations on several claims in this district, stocking their mines in San Francisco. Among these companies incorporated in California, and who are now vigorously developing their properties, are the

SOUTH EMMA AND THE WELLINGTON.

The mine of the South Emma Company lies in the line and on the level of the Emma lode, near the Emma mine, and in the same relation to it by locality as the Gould & Curry mine is to the Hale & Norcross on the Comstock. The mine is opened by an incline dipping at an angle of about 40 deg. for a depth of 100 feet, from which a horizontal drift runs into the hill in the direction of the lode for sixty feet further, following continually improving indications and approaching the exact line and level of the Emma. This drift is being run day and night, with three shifts of hands, and in the extreme face of it, within a few days, the character of the rock is exactly similar to that which causes the solid ore lodes of all of the great mines of the belt, showing in mass a small amount of lead and silver, with occasional rich fragments of ore imbedded in the body of the rock. The farthest point of the drift is about 150 feet perpendicular below the surface, and the present level will be continued until a body of ore is struck, when longitudidal drifts will be run. It has been found necessary, because of the collection of water in the incline from the infiltration of the melting snow upon the surface, to employ an extra force of hands—a necessity that will disappear with the disappearance of the snow, as all the mines on the lower levels are perfectly dry except from the cause stated The title to the mine is, I understand, perfect, and the prospect of its becoming very valuable, I consider, for the reasons stated, as certainly assured as anything in the nature of mining operations can be.

The Wellington mine is opened by an incline of 180 feet in depth, with five levels run on its length. Of these levels, two are on large and rich ore lodes as far as run, the one at the bottom of the incline being on a lode of solid ore from two to fifteen feet in width, and of an average value of $150 per ton. The Smelting furnaces of the Company have suspended operations for a few days, but only on account of the bad condition of the roads, and the utter impossibility of obtaining fuel except at an enormous cost.

THE QUESTION OF FUEL

has been the most serious hindrance to rapid developments of the mines. The immense quantity of smelting ore here would have soon exhausted in its reduction all of the charcoal available, except at a price for the article that would have embargoed the reduction of low and middling grade ores. It was assumed upon very imperfect experiment that the Rocky Mountain coal would not coke. Mr. Stowe, a San Franciscan, who has a lease of the Hinton mine at Evanston, a few weeks ago employed some cokers and essayed the experiment of converting coal to coke upon a large scale with almost perfect success. This success settles the question of fuel. Coke can be furnished at the mines in any quantity and at a price that will reduce the fuel cost of smelting one-half, and this makes available mines that else could not have been worked, and greatly increases the profits of those that yield ore rich enough to be worked at a profit, even under the present expensive system of smelting.

A number of important sales of mines in Camp Floyd District have taken place within the past week. The purchasers are Chicagoese, and are probably trying to play even on the big fire—may these ventures restore their financial equilibrium.

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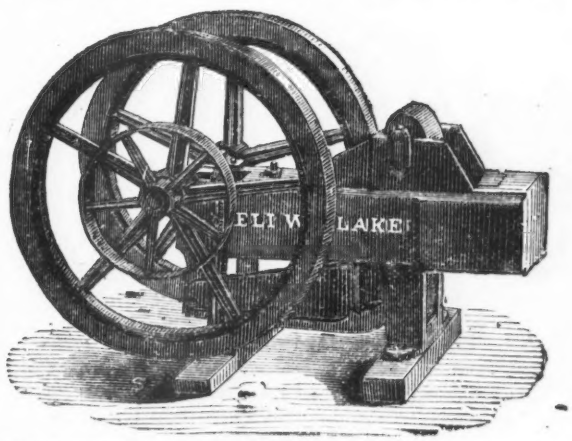

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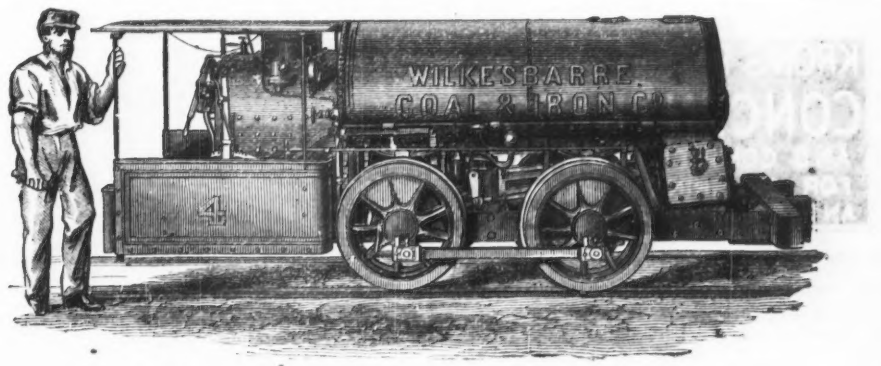

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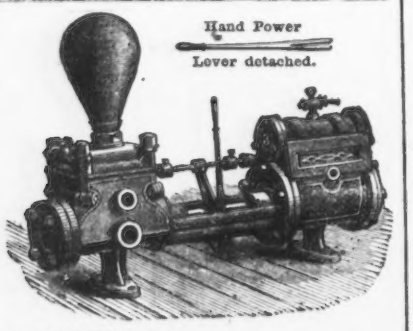

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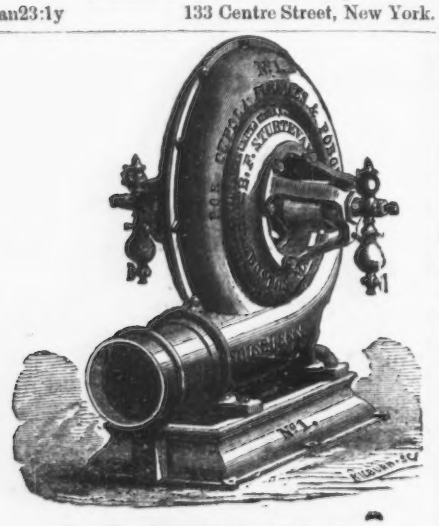

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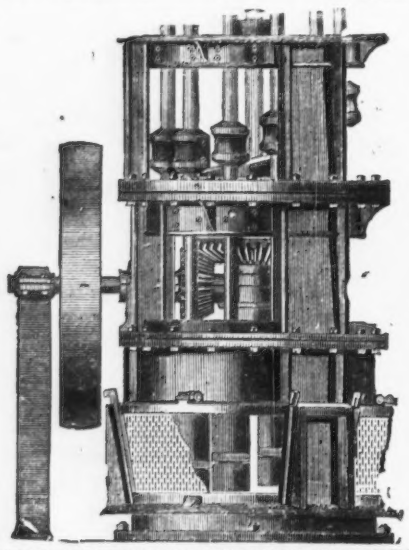

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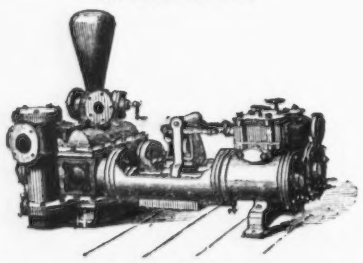

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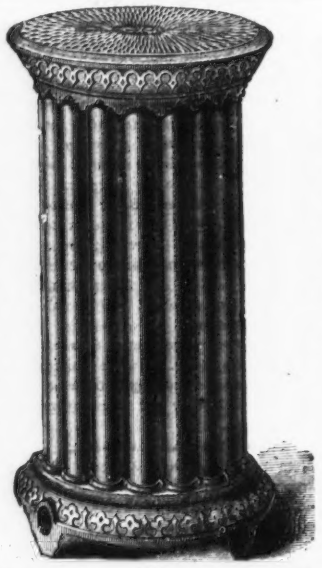

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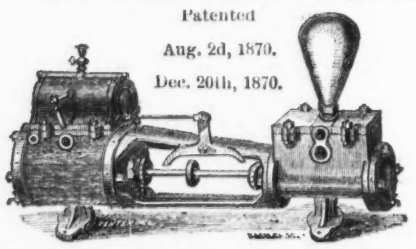

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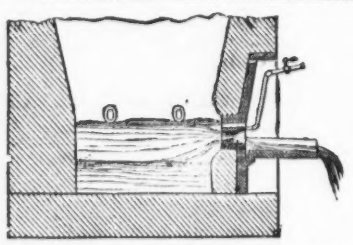

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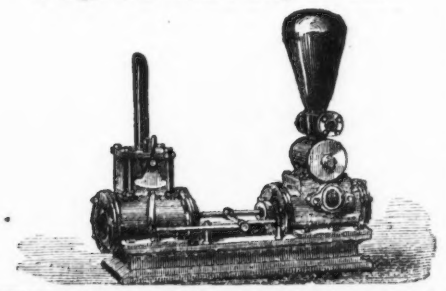

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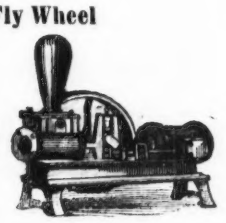

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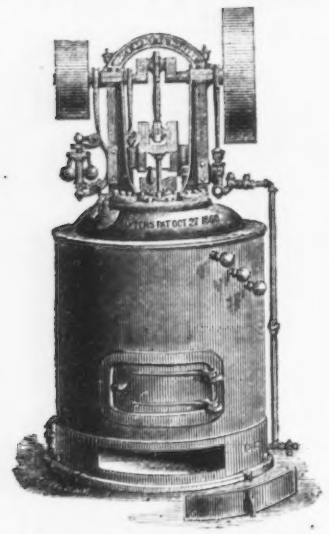

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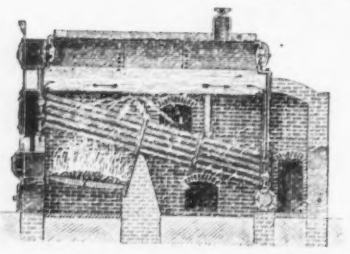

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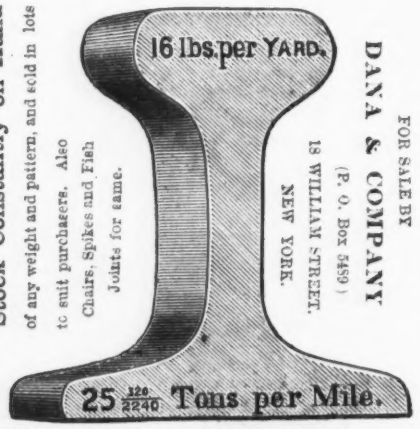

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